Britain: From rationing to gluttony (1945-1969)

Following the deprivations of the Second World War, Britain struggled to stem the costs of decommissioning large parts of her military while rebuilding the national industry. Trying to prevent a rise of expensive food imports in the face of bad harvests, the British government embarked on a program of subsidized and state-controlled agricultural expansion. At the same time, national consumption was held in check by maintaining the wartime system of rationing. Ultimately, the prolonged disruption of international trade, colonial campaigns and the Korean War made post-war rationing last longer than the entire Second World War. Indeed, food availability actually decreased between 1946 and 1948.[1] It was only in 1954 that the British Ministry of Food (MoF) was dismantled along with its rationing system.[2] By this time, consumers were craving meat: between 1950 and 1955 UK meat consumption increased by 14.4 per cent, between 1950 and 1960 by 20.2per cent and between 1950 and 1970 by 33.1per cent.[3]

Interestingly, the decision to end rationing coincided with the liberalization of antibiotic use in Britain. Fearing antibiotic resistance, the British government had initially limited antibiotic use with the Penicillin Act of 1947. In accordance to the act, antibiotics were turned into prescription-only medicines (POMs).[4] However, in 1953, the Therapeutic Substances (Prevention of Misuse) Act (TSA) exempted the use of antibiotics for feed purposes from prescription requirements.

Initially, most domestic observers welcomed agricultural antibiotics as a progressive way of satisfying rising levels of meat consumption and enhancing British nutritional independence. Prior to their legalization, the conservative *Times* repeatedly stressed agricultural antibiotics' benefits:[5] titled "Twentieth-Century Hen", one article described subtherapeutic antibiotics as a "strange

[1] Cf. Ina Zweiniger-Bargielowska, *Austerity in Britain: Rationing, Control and Consumption 1939-1955* (Oxford and New York: Oxford University Press, 2002), p. 37.
[2] Ibid., p. 73.
[3] *Food Choice, Acceptance and Consumption* (London: Blackie Academic & Professional 1996), p. 377.
[4] Cf. Stuart Anderson, *Making Medicines: A Brief History of Pharmacy and Pharmaceuticals* (London and Grayslake: Pharmaceutical Press, 2005), p. 248.
[5] Cf. 'Feeding-Stuff Experiments', *Times,* 08.07.1952, p. 3; 'Animal Nutrition. Use Of Antibiotics', *Times*, 10.09.1952, p. 7; 'Losses From Animal Diseases', *Times,* 08.09.1953, p. 3.

nutrition" with the potential to solve the "world-wide shortage of protein".[6] Advocating the benefits of antibiotic-liberalization, the *Times* subsequently informed readers about the Medical Research Council's study of antibiotic feeds.[7] Three years after the TSA, the newspaper's optimism for agricultural antibiotics had not abated. Reporting on the use of aureomycin (chlortetracycline) in food preservation, one article described it as "'the greatest advance in the field of processing perishable foods since the advent of refrigeration.'"[8]

Written during a time of great technological enthusiasm, the media's optimism regarding agricultural antibiotics is not surprising. After all, prospects of using radioactive wastes for food preservation and breeding received equally gushing media-coverage.[9] At the same time, antibiotics were viewed as a quintessentially British contribution to modernity.[10] When the American company Pfizer opened a new terramycin-plant in Sandwich in 1955, Pfizer's vice-president was quick to stress the plant's *Britishness*: "although the installation was financed by the United States it was partly designed and wholly built and operated by the British."[11]

Occasionally, there were also critical voices regarding antibiotics' mass-introduction to British food production. In 1951, Lord Douglas of Barloch warned against the increasing use of "poisonous chemicals in the growing and preparation of foodstuffs."[12] Focusing on antibiotics, DDT and hormones, the former Labour Parliamentary Secretary called "for strict control over all processes which might affect the natural quality of food."[13] In February 1953, Tory MP Mr. Dodds asked Minister Thomas Dugdale how consumers could be protected when "famous experts (…) have declared that more harm than good" [14] would result from the TSA. Seconding Dodds' concerns, Tory MP Colonel

[6] G. R. H. Nugent, 'The Twentieth-Century Hen', *Times*, 30.07.1951, p. 5.
[7] Cf. 'Pigs Fattened By Antibiotics', *Times*, 01.12.1952, p. 3.
[8] 'New Method Of Food Preservation', *Times*, 11.04.1956, p. 13.
[9] Cf. 'News from Industries. Research to Develop Uses of Radioactive Waste', *Times*, 15.06.1955, p. 5; Henry Seligman, 'Radioactivity In Wide Use', *Times*, 17.10.1956, p. xi.
[10] Cf. Robert Bud, *Penicillin: Triumph and Tragedy* (Oxford: Oxford University Press, 2009), pp. 67-72.
[11] 'New Antibiotic Plant Opened. Saving Of Dollars', *Times*, 01.10.1955, p. 4.
[12] 'Parliament. House of Lords Wednesday, July 4', *Times*, 05.07.1951, p. 4.
[13] Ibid.
[14] Extract, House of Commons (P.Q. 3355), Question put on 19th February, 1953 (Pig Fattening), TNA MAF 287/299.

Gomme-Duncan asked "whether we have all gone mad to want to give penicillin to pigs to fatten them?"[15]

Lord Barloch, Dodd and Gomme-Duncan were not alone with their fears. Following a report on the TSA,[16] readers of the social-liberal *Observer* engaged in a heated exchange on the respective benefits and dangers of antibiotic feeds. Writing to the editor, the anthroposophic author Olive Whicher warned that antibiotics' destruction of the intestinal microflora and the resulting loss of B-vitamin production might cause infertility.[17] Acknowledging Whicher, the farmer G. Pelham Reid claimed that "powerful forces interested in the manufacture and distribution of these drugs and feeding stuffs" were making it "increasingly difficult for the farmer to know fact from fancy."[18] Responding to such criticism, J. A. Wakelam from the pharmaceutical manufacturer J. Bibby & Sons defended agricultural antibiotics:

> … had we waited to consider exhaustively the long-term effects of antibiotic therapy, many human lives would have been lost to-day. The international food situation is so desperate that we must be prepared to accept the assistance which modern science offers us and not seek by quoting individual contrary opinions to discredit the conclusion of reputable bodies such as the Agricultural Research Council, …[19]

However, on the whole, early media coverage tended to be optimistic. In 1957, the *Times* featured a lengthy report by the food chemist Alfred Louis Bacharach on chemicals' new role in food production.[20] With strict government controls in place, Bacharach announced that "'chemicals in food' is no longer necessarily a term of abuse":[21]

> Although traces of such substances may remain in the final food, this is the exception, as they have usually been converted to harmless breakdown products, (…) or been removed during subsequent stages of processing. In other cases they are destroyed by exposure to atmospheric oxygen or by the digestive ferments of the consumer.[22]

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[15] Ibid.
[16] Cf. 'Fatter Pigs on Penicillin', *Observer*, 30.11.1952, p. 3.
[17] Cf. Olive Whicher, 'Penicillin for Pigs', *Observer*, 28.11.1952, p. 2.
[18] G. Pelham Reid, 'Guidance Required', *Observer*, 04.01.1953, p. 3.
[19] Cf. J. A. Wakelam, 'Penicillin for Pigs', *Observer*, 04.01.1953, p. 3.
[20] Cf. A. L. Bacharach, 'Use Of Chemicals In Food', *Times,* 26.07.1957, p. 11.
[21] Ibid.
[22] Ibid.

Reacting to growing British demand, American pharmaceutical companies such as Pfizer and the Lederle Laboratories of American Cyanamid raced to establish factories and sales departments in Britain. In contrast to their British competitors, American companies courted potential clients both in- and outside traditional agricultural circles.[23] Although farmers only constituted ca. 5 per cent of the population,[24] the American companies placed expensive advertisements for feeds in national newspapers. In 1953, Lederle purchased an entire page of the *Times* ahead of the launch of its chlortetracycline-based feed AUROFAC 2A.[25] Experienced sales personnel was also in high demand: in 1956, a Pfizer-advertisement announced that the "world's largest producer of antibiotics" was "expanding its Agricultural Sales Force" and looking for male British personnel with an agricultural background and experience in "modern sales techniques."[26] Only three days later, Lederle announced that it, too, was looking for "top-class Sales Representatives who will sell Animal Feed additives such as Aurofac."[27] Applicants should be men "who can use initiative and are determined to succeed in a selling career."[28] Celebrating the establishment of its Gosport plant in 1958, Cyanamid's national advertisement campaign proclaimed:

> The international ramifications of this giant industrial concern are bringing untold benefits to almost every sphere of life. In agriculture for example, livestock benefits in health and growth from AUROFAC Aureomycin Feed Supplements (…). Backed by over 40 plants and 30,000 employees, Cyanamid contrives to make a new discovery almost every day, transmuting the hopes of yesterday into the realities of today.[29]

By the late 1950s, agricultural antibiotics began encountering more sustained public opposition. However, instead of presenting a united front, opposition against agricultural antibiotics was divided along distinct topic-lines. While one camp focused on the spread of antibiotic-resistant pathogens, a second camp was more concerned about antibiotics' presence in basic foodstuffs

[23] The only British advertisement of this period that I could find is a small job-posting by Boots for veterinary scientists interested in work on animal growth promotion at Boots' Veterinary Science Division at Thurgarton; cf. 'Commercial Boots Pure Drug Co.', *Times*, 12.11.1957, p. 2.
[24] 'Fewer farmers in Europe', *Farmers Weekly* Vol. LX No. 4 (1964), S. 48.
[25] 'Commercial Cyanamid', *Times*, 17.07.1953, p. 5.
[26] 'Commercial Pfizer Ltd.', *Times*, 26.06.1956, p. 2.
[27] 'Commercial Cyanamid 'Are You A Sales Maker'', *Times*, 29.06.1956, p. 2.
[28] Ibid.
[29] 'Commercial Cyanamid 'Building for a better world'', *Times,* 16.04.1958, p. 7; cf. also: Ibid, *Observer*, 20.04.1958, p. 7.

and the environment. A third camp condemned antibiotics as accomplices to the deplorable conditions of animals in intensive sties. Depending on one's position within the various opposition camps, agricultural antibiotics' image could thus vary from endangered miracle substance to dangerous adulterator or partner in cruelty.

In agriculture, early resistance problems were most prominent in the dairy sector, where cows frequently suffered from painful bacterial infection of the udder known as mastitis. By the end of the 1950s, a growing number of cows suffering from staphylococcal mastitis did not recover following treatment with penicillin or aureomycin. Reporting on the situation in 1961, the *Times* announced that mastitis infections were costing British farmers over £1.500.000 annually.[30] Although veterinarians' generous antibiotic prescriptions were partly responsible, the *Times* sided with the experts in blaming lay-farmers' use of antibiotics and lacking hygiene for spreading resistant mastitis.[31]

In a similar vein, veterinarians accused farmers' use of subtherapeutic antibiotics for increasing resistance: in 1959, the *Times* reported on a paper given by Dr E. L. Taylor at the annual congress of the British Veterinary Association (BVA). In his paper, Taylor warned that subtherapeutic antibiotics eliminated competing microorganisms and enabled resistant pathogens to spread rapidly.[32] Four months later, the Agricultural Research Council (ARC) suggested a general review of medical feed additives such as antibiotics and hormones.[33] As a result of these warnings, the British government launched a joint inquiry into agricultural antibiotics. Chaired by the recently retired president of the National Farmers' Union (NFU), James Turner – now Lord Netherthorpe –, the committee sat between 1960 and 1962. In 1962, it reported that it had been unable to establish a link between human and animal resistance.[34]

Surprising for 21st century readers, this apparent equanimity regarding antibiotic resistance can be explained by more pressing concerns about the

[30] 'Farm Health Problems In New Methods', *Times*, 11.09.1961, p. 7.
[31] Cf. Ibid.
[32] Cf. 'Working Out Policy For Disease Control', *Times*, 14.09.1959, p. 19.
[33] Cf. 'Farming Notes And Comments', *Times*, 18.01.1960, p. 21.
[34] Cf. Bud, *Penicillin: Triumph and Tragedy*, pp. 174-75.

chemical and radioactive contamination of food and the environment. Both invisible and flavourless, it was easy for consumers to link radioactive and chemical contamination in their minds. During the late 1950s, the resulting scenario of omnipresent yet diffuse environmental hazard was heightened by a series of scandals: in 1956, flour contaminated with the insecticide endrin poisoned 59 people in the Welsh town of Pontardawe.[35] Although the case received national publicity, it was overshadowed one year later by a severe accident in the recently opened nuclear power plant at Windscale. Following a fire in one of Windscale's reactors, significant amounts of radionuclides were released and contaminated ca. 200 square miles of land surrounding the reactor. As a result, the government issued a month-long ban of milk production in affected areas.[36] The accident came at a time when elevated strontium-levels in animal and human milk were already provoking international protest against nuclear tests.[37]

Similar to concerns about radioactivity, public fears about the chemical contamination of food peaked in the early 1960s. In 1960, the *Times* described the "increasing use of poisonous chemicals in agriculture"[38] as a serious challenge to food safety. Although they were described as "innocuous",[39] antibiotics were listed amongst the chemicals requiring constant monitoring. One year later, the already familiar Lord Douglas of Barloch renewed his attack on agricultural chemicals and antibiotics. Speaking in the House of Lords, Barloch claimed to be more concerned about agricultural chemicals than ever:

> Little had been done to protect the consumer. It was well known that the extensive use of antibiotics might lead to the proliferation of bacteria more dangerous than those the antibiotic was designed to destroy. (…). The use of synthetic chemicals should be banned completely with the possible exception of some substances that after long use seemed to be beyond suspicion.[40]

[35] Cf. D. T. Lewis, 'Complex Chemical Control', *Times*, 20.09.1960, p. xvi.
[36] 'Farmers Given Assurance On Reactor Effects', *Times*, 23.10.1957, p. 6.
[37] Cf. Kendra Smith-Howard, 'Antibiotics and Agricultural Change: Purifying Milk and Protecting Health in the Postwar Era', *Agricultural History Society,* 84/3 (2010), p. 342, Kendra D. Smith-Howard, 'Perfecting Nature's Food: A Cultural and Environmental History of Milk in the United States, 1900-1970', (University of Wisconsin-Madison, 2007), pp. 227-60, Bud, *Penicillin: Triumph and Tragedy*, p. 171.
[38] D. T. Lewis, 'Complex Chemical Control', *Times*, 20.09.1960, p. xvi.
[39] Ibid.
[40] 'Parliament. House of Lords', *Times*, 16.06.1961, p. 20.

This time, Barloch could count on the vocal support of many peers. While Lord Amwell claimed that Britain would be "happier, better, and more moral if there was eating food 'straight from the earth'"[41], Lord Hankey extolled the virtues of his wife's pure wholemeal bread. Further support came from Lord Kilbracken, who praised the Soil Association's recently opened organic Wholefoods store in London. Responding to Barloch's accusations, the government's Lord in Waiting, Lord Hastings, claimed that the government was in control of additives and warned against equating additives with contamination. Instead, additives should be seen as part of the "general process of civilization."[42] Using a telling example, Lord Hastings pointed out that eating two pounds of game birds with elevated mercury-levels would cause nothing more than "mild indigestion."[43]

In contrast to the Lords' focus on game, common consumers were far more concerned about contaminated milk. As shown by Kendra Smith Howard, 1960s consumers were particularly weary of tainted milk because of milk's association with purity and natural health.[44] In this context, antibiotics played a prominent role: after being treated for mastitis with antibiotics, cows secrete the drugs in their milk. Depending on the dosage and the medication used, a certain waiting period is necessary for milk to clear of antibiotics. Either ignorant of waiting periods or eager to forego production losses, some farmers sold contaminated milk to dairies from where it was passed on to British consumers. Meanwhile, other farmers 'sprinkled' antibiotics into their milk to prevent it from spoiling.[45] Aware of the problem since the early 1950s,[46] C. D. Wilson from the Central Veterinary Laboratory at Weybridge publicly exhorted veterinarians to protect consumers from drinking "diluted pus with noxious additions such as penicillin."[47]

However, these warnings went unheard. In 1963, a national survey by the Milk and Milk Products Technical Advisory Committee found that 14per cent of

[41] Ibid.
[42] Ibid.
[43] Ibid.; one year later, a similar House of Lords discussion focussed on potentially carcinogenic chemical fertilisers; cf. ''No evidence' of cancer risk from fertilisers', *Guardian*, 04.05.1961, p. 2.
[44] Cf. Smith-Howard, 'Antibiotics and Agricultural Change: Purifying Milk and Protecting Health in the Postwar Era', pp. 327-28.
[45] Cf. Bud, *Penicillin: Triumph and Tragedy*, p. 171.
[46] 'Effect Of Penicillin On Cows' Milk', *Times*, 22.12.1950, p. 2.
[47] 'Farm Health Problems In New Methods', *Times*, 11.09.1961, p. 7.

English and 11.6per cent of Scottish milk tested positive for antibiotics.[48] The report received widespread media attention.[49] In an article titled "Cow Punch"[50], the *Guardian's* Michael Winstanley announced that the days of 'pure' food were long gone. For Winstanley, food additives were a double-edged consequence of contemporary population growth and the need to produce and preserve more food. Referring to the recent thalidomide-scandal, Winstanley demanded more consumer-protection from pharmaceuticals and questioned voluntary measures' efficacy.[51] One year later, the *Times* informed readers that official tests only tracked penicillin and could not reliably indicate the presence of other common antibiotics in milk.[52] Throughout the mid-1960s, reports about antibiotics in milk frequently appeared in British newspapers.[53]

In addition to resistant pathogens and antibiotic residues, growing concern about animal rights constituted a third strand of antibiotic-criticism. By the late 1950s, numerous aspects of industrialized agriculture such as battery cages and the methods used to fatten calves and breed pigs provoked the ire of animal welfare advocates.[54] In 1959, the *Observer's* Clifford Selly described in shocking detail the "highly artificial conditions" in which the "ill-fated chickens" lived.[55] Never seeing daylight, the broilers were "heavily drugged to keep them alive" and were victims of a system "more akin to the factory than the farm."[56] Over the next two weeks, Selly's article provoked passionate reader responses. Whereas G. B. Houston accused the "poor, deluded city dweller" of consuming "drugged and misused broiler fowls"[57], F. A. Dorris Smith recommended visits to broiler houses by women's organizations to "bring this abomination to an end."[58]

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[48] 'Drug hazard in dairy milk', *Guardian*, 30.05.1963, p. 1.
[49] Cf. 'Keeping Milk Free Of Antibiotics', *Times*, 30.05.1963, p. 18;
[50] Michael Winstanley, 'Cow Punch', *Guardian*, 25.06.1963, p. 6.
[51] Cf. Ibid.
[52] Cf. 'Danger Of Drugs In Milk', *Times*, 04.12.1964, p. 6.
[53] Cf. 'Testing of milk for antibiotics extended', *Guardian*, 25.02.1964, p. 2; 'What cures cow can harm milk', *Guardian*, 12.02.1965, p. 17; Anne Taylor, 'Ban this drug' plea to Minister, *Observer*, 28.03.1965, p. 13; 'Threat of tainted milk', *Observer*, 16.05.1965, p. 2; 'Tests Of Milk For Antibiotics', *Times*, 27.09.1965, p. 14; 'Untreated milk a danger', *Guardian*, 25.10.1965, p. 3.
[54] Cf. 'Concern About Toxic Sprays Persists', *Times*, 10.03.1961, p. 18; for a summary of the accusations cf. 'Editorial: Techniques in Question', *Farmers Weekly* Vol. LX No. 11 (13.03.1964), p. 43.
[55] Clifford Selly, 'Broilers Under Fire', *Observer*, 08.03.1959, p. 3.
[56] Ibid.
[57] G. B. Houston, 'Letters to the Editor: Broiler Fowls', *Observer*, 15.03.1959, p. 4.
[58] F. A. Dorris Smith, 'Letters to the Editor: Broiler Fowls', *Observer*, 15.03.1959, p. 4.

In another letter, John Archer specifically blamed antibiotics for causing animal rights abuses.[59]

By the mid-1960s, the three distinct strands of antibiotic-criticism were well established. However, critique of one and the same substance continued to be divided according to distinct fears of resistance, residues and animal cruelty. With criticism rarely overlapping, no single issue was strong enough to challenge the well-entrenched use of agricultural antibiotics. In order for a potent ecology of fear[60] to emerge, antibiotic opposition needed common identification figures, texts and scandals. In 1964, Ruth Harrison's whistle-blower publication *Animal Machines* provided all of the above and turned both the book and its author into rallying points for antibiotic-critics. [61]

A Quaker, Harrison had worked for the Friends Ambulance Service during the Second World War. After 1945, she attended the Royal Academy of Dramatic Art and was coached by the prominent animal rights activist George Bernard Shaw. However, it was a letterbox-leaflet against animal cruelty that turned Harrison into an active campaigner against intensive animal husbandry.[62] In *Animal Machines*, Harrison combined scientific findings with simple language and vivid descriptions to alert readers to animals' plight in factory-like production systems. Appearing one year after the UK publication of Rachel Carson's *Silent Spring*[63] and containing a foreword by Carson herself, *Animal Machines* successfully linked the topics of animal welfare, agricultural antibiotics and dangerous food residues. Harrison's authority was further strengthened by a preface from Sydney Jennings, a former BVA-president. Claiming that "meat eating has become a hazard"[64], Harrison repeatedly pointed to the connection between modern farmers' antibiotic-dependency, animal cruelty, antibiotic

[59] John Archer, 'Letters to the Editor: Broiler Fowls', *Observer*, 22.03.1959, p. 4.
[60] Cf. Stephen Hilgartner and Charles L. Bosk, 'The Rise and Fall of Social Problems: A Public Arenas Model', *American Journal of Sociology,* 94/1 (1988).
[61] Ruth Harrison, *Animal Machines* (London: Vincent Stuart Ltd, 1964), p. 7.
[62] Richard D. Ryder, 'Harrison, Ruth (1920-2000)', *Oxford Dictionary of National Biography*, Oxford University Press, 2004; online edn, May 2005 [http://www.oxforddnb.com/view/artcilde/74285, accessed 16 Feb 2013]
[63] Rachel Carson, *Silent Spring* (New York: First Mariner Books, 2002).
[64] Harrison, *Animal Machines*, p. 7.

residues in foodstuffs and the creation of resistance in sties.[65] For Harrison, it was

> … ironic to think that while authorities are steadily urging that antibiotics be used only with great discrimination on the grounds of dangerous resistance building up, the agricultural authorities are encouraging even wider use. Perhaps, these two should get together some time to discuss the matters, before it is too late.[66]

Interestingly, neither *Silent Spring* nor *Animal Machines* contained significant new findings: bodies like the Audobon Society had been warning against the use of DDT for years. However, it was Carson who managed to fuse concerns about DDT's environmental impact with more intimate concerns about personal health.[67] Building on *Silent Spring* and profiting from the scandal of contaminated milk, Harrison linked agricultural systems, antibiotics and human health in a way that no publication had managed before. As a consequence of *Animal Machines*, agricultural antibiotics, residues and 'factory farming' merged in the public's mind.

The attention paid to *Animal Machines* was impressive. Prior to its publication, the *Observer* had printed excerpts of *Animal Machines*. Titled "Inside the animal factories"[68] and "Fed To Death"[69], Harrison's articles introduced readers to the main aspects of her book. In the first article, Harrison accused the "factory farmer and the agri-industrial world behind him"[70] of acknowledging cruelty only when profitability ceased. As long as growth remained stable, rearing systems and substances were not questioned. A case in point, antibiotics were "incorporated in [animals'] feed and heavier doses of drugs given at the least sign of flagging."[71] Focussing on poultry and battery hens, Harrison described in excruciating detail debeaking, mass housing, life in perpetual twilight and mass slaughtering. Providing pictures of animals' living conditions, Harrison claimed that it was common for young birds suffering from respiratory

[65] Ibid., pp. 116-20.
[66] Ibid., p. 120.
[67] Cf. Christian Simon, *Ddt. Kulturgeschichte Einer Chemischen Verbindung* (Basel: Christian Merian Verlag, 1999), pp. 14-21, Edmund Russell, *War and Nature. Fighting Humans and Insects with Chemicals from World War I to Silent Spring* (Cambridge and New York: Cambridge University Press, 2001), pp. 204-23.
[68] Ruth Harrison, 'Inside the animal factories', *Observer*, 01.03.1964, p. 21.
[69] Ruth Harrison, 'Fed To Death', *Observer*, 08.03.1964, p. 21.
[70] Harrison, 'Inside the animal factories', p. 21.
[71] Ibid.

diseases or cancer to end up on consumers' tables – the birds' ill health masked by antibiotics.[72]

The fattening of tethered calves in darkened sties with slatted concrete floors was the subject of Harrison's second article. Calves' diets consisted almost "exclusively of barley, with added minerals and vitamins, antibiotics, tranquilisers and hormones."[73] Living in these conditions, some calves became blind and many suffered from liver-damage and pneumonia: "their muscles become flabby and they put on weight rapidly, *but they are not healthy."*[74] Using more antibiotics to keep animals alive, farmers and veterinarians contributed to a race "between disease and new drugs."[75] Quoting veterinary practitioners and the 1962 Netherthorpe report, Harrison warned about antibiotic resistance in sties and residue-laden "tasteless meat"[76] from factory farms.

Reactions to Harrison's claims ranged from furious denial to emphatic support. Seven days after publishing the last article, the *Observer* had received around 320 letters regarding *Animal Machines*.[77] Many readers were outraged by Harrison's revelations: Helen Simpson compared animals' suffering to 19th century child labour;[78] Sheila Mitchell demanded labelling products from intensive farms;[79] and Barbara Willard asked her fellow readers to imagine their pets incarcerated in factory farms.[80] While John Hall, the Chief Secretary of the Royal Society for the Prevention of Cruelty to Animals (RSPCA), praised Harrison,[81] the animal health lecturer David Sainsbury accused her of presenting a "grossly distorted picture of what is *actually* happening."[82] According to Sainsbury, subtherapeutic antibiotics had never been shown to harm humans. Meanwhile, the Dean of Llandaff in Wales compared factory farms to Nazi concentration camps and embarked on a public campaign against them: in a

[72] Cf. Ibid.
[73] Harrison, 'Fed to Death', p. 21.
[74] Ibid.
[75] Ibid.
[76] Ibid.
[77] 'Views on animal factories', *Observer*, 15.03.1964, p. 30.
[78] Helen M. Simpson, 'Views on animal factories: Poles apart', *Observer*, 15.03.1964, p. 30.
[79] Sheila M. Mitchell, 'Views on animal factories: Label them', *Observer*, 15.03.1964, p. 30.
[80] Barbara Willard, 'Views on animal factories: Try it on the dog', *Observer*, 15.03.1964, p. 30.
[81] John Hall, 'Views on animal factories: changing the law', *Observer*, 15.03.1964, p. 30.
[82] David Sainsbury, 'Views on animal factories: distorted', *Observer*, 15.03.1964, p. 30; Sainsbury's attack was also motivated by the appearance of his name in *Animal Machines*: cf. Harrison, *Animal Machines*.

speech covered by both the *Daily Mirror* and the *Guardian*, the Dean warned his congregation about food-contamination with residues of antibiotics, hormones and other drugs.[83] Subsequently, similar appeals called for an end of antibiotic-abuse on "farm Belsens."[84] In parliament, the Labour MP Joyce Butler launched an inquiry into the agricultural use of chemicals and residues in food.[85]

Reacting to public outrage in June 1964, the British government launched a committee to analyse animal welfare under the direction of Professor F. W. Rogers Brambell. Acknowledging Harrison's role, the government made her a member of the cumbersomely-named Technical Committee to Enquire into the Welfare of Animals kept under Intensive Livestock Husbandry Systems.[86] Published in late 1965, the so-called 'Brambell-Report' granted animals five basic freedoms: animals were to be (1) protected from hunger and thirst, (2) protected from discomfort, (3) protected from pain, injury or disease, (4) granted the freedom to express normal behaviour, (5) and protected from fear and distress. A further result of the committee's work was the establishment of a permanent Farm Animal Welfare Advisory Committee.[87]

At this point, it is, however, important to note that not all British newspapers joined the campaign against 'factory farming' and agricultural antibiotics. While left-wing newspapers like the *Observer* became platforms of criticism, the conservative *Times* did not take up the cause against 'factory farms' whole-heartedly. Still publishing articles titled "Feeding The World"[88], the *Times* remained influenced by the Malthusian outlook of the 1950s and stressed Britain's responsibility for feeding and improving the developing world. Published during a time of rapid decolonization, these articles mixed technological optimism with an obvious desire to find legitimate ways of maintaining British influence in the postcolonial world. Although the *Guardian*

[83] Cf. 'Cruelty War By Church leader', *Daily Mirror*, 10.08.1964, p. 3; cf. ''Intensive' farming condemned', *Guardian*, 10.08.1964, p. 3.
[84] 'Get rid of farm Belsen', *Observer*, 24.10.1965, p. 9.
[85] 'Hazard to health in food?', *Guardian*, 28.03.1964, p.28.
[86] 'Charter suggested for animals' condition', *Guardian*, 25.11.1965, p. 13.
[87] Cf. 'Five Freedoms', [Webpage], <http://www.fawc.org.uk/freedoms.htm>, accessed 24.02.2013 2013.
[88] 'Feeding The World', *Times*, 19.09.1962, p. ii.

and the *Daily Mirror* featured similar reports,[89] the *Times* was unique as to their frequency.

Regarding agricultural antibiotics, the *Times* maintained an equally positive attitude and praised antibiotics' role in improving and standardizing animals' growth.[90] Critical of residues in milk, the *Times* still printed the views of W. R. Trehane, chairman of the monopolist Milk Marketing Board (MMB), who claimed that public criticism was out of proportion and that the risks resulting from tainted milk were "extremely small."[91] Five months after the appearance of *Animal Machines*, the *Times'* farming section reported favourably on new preventive antibiotics for stress during livestock transports.[92] In 1965, the *Times* published an article titled "Why The American Farmer Can Cope Single-Handed."[93] Reporting on a recent visit to the American Midwest, the newspaper's agricultural correspondent enthusiastically described American farmers' technological sophistication and farms of a size that "we in England would consider impossible."[94] In the case of feedlots, the correspondent's remarks read like a direct challenge to Ruth Harrison:

> The switch from ranch to feedlot is so drastic that many of the cattle suffer at first from stress. This is aggravated by the rough treatment they often receive. With such huge numbers there is no scope for individual idiosyncrasies. All the animals go through the mill, which includes inoculations, castrating, dehorning, medical treatment, anything else that seems desirable. To fortify them in the ordeal they have pumped into them vitamins, antibiotics, hormones, and tranquilizers. Animal nutrition, in all its aspects, is a remarkably advanced science in the States. Impressive results are achieved.[95]

Throughout the 1960s, the *Times* also remained a preferred place for the antibiotic-commercials of Pfizer and Cyanamid. Oblivious to reports on antibiotic resistance, companies stressed their products' dual application in humans and animals.[96] In 1961, Cyanamid started an aggressive advertisement campaign for

[89] Cf. Arthur Smith, 'This Means Hope For Millions', *Daily Mirror*, 06.11.1964, p. 13; 'Growing role for the chemist in feeding 6,000m. by AD 2,000', *Guardian*, 03.11.1965, p. 5.
[90] Cf. 'Pig Records As Pointers To Defects', *Times*, 25.09.1961, p. 6.
[91] Verbatim speech record by W. R. Trehane in: 'Milk Marketing Board', *Times*, 19.07.1965, p. 16.
[92] Cf. 'Farming Notes and Comments: Protecting Calves', *Times*, 17.08.1964, p. 6.
[93] 'Why The American Farmer Can Cope Single-Handed', *Times*, 28.06.1965, p. 14.
[94] Ibid.
[95] Ibid.
[96] Cf. 'Commercial Cyanamid: 'Don't Smile Back; She's Blind', *Times*, 12.01.1961, p. 5.

Aureomycin. Printed in April, one advertisement for Cyanamid's aureomycin-based Aurofac-feed showed a laughing pig exclaiming: "Yes, I'm A Scientific Pig"[97]. In the following text, Cyanamid presented agricultural antibiotics as a progressive way of improving animals' well-being and farmers' profits: "Indeed, to quote the vernacular, pigs in Britain 'never had it so good'…"[98] Two months later, Cyanamid published another commercial with a cow saying "'I Feel Fine Now, Thank You…"[99] This time, the company presented Aureomycin as the perfect answer to Bovine Mastitis.[100] In October 1961, Cyanamid praised Aureomycin as a proven medication for laying birds. Casually referring to living conditions in sties, the advertisement claimed that Aureomycin prevented any "disastrous rise of mortality."[101]

Nonetheless, retrospectively, *Animal Machines* and the events following its publication marked a watershed in British discussions of agricultural antibiotics. In the same year that Ruth Harrison linked antibiotic resistance, residues and cruelty in the public's mind, the last major British outbreak of typhoid brought home the potential microbiological hazards of industrial food production. Occurring in Aberdeen, the 1964 outbreak was caused by Argentinian meat contaminated with *Salmonella typhi*.[102] While the Aberdeen *S. typhi* strain responded to antibiotic therapy with chloramphenicol,[103] experts were concerned that future outbreaks might prove resistant to antibiotic treatment.

This was due to a changing perception of the mechanisms behind bacterial antibiotic resistance. As shown by Christoph Gradmann, the 1950s were characterised by a 'vertical' view of hereditary resistance proliferation,

[97] 'Commercial Cyanamid: ‚Yes, I'm A Scientific Pig', *Times*, 14.04.1961, p. 5.
[98] Ibid.
[99] 'Commercial Cyanamid: 'I Feel Fine Now, Thank You…", *Times*, 22.06.1961, p. 5.
[100] Cf. Ibid.
[101] Ibid.
[102] The Aberdeen outbreak and its political and regulatory outcomes are studied in great detail in: David F. Smith et al., *Food Poisoning, Policy and Politics. Corned Beef and Typhoid in Britain in the 1960s* (Woodbridge: The Boydell Press, 2005), Lesley Diack et al., 'Departmental, Professional, and Political Agendas in the Implementation of the Recommendations of a Food Crisis Enquiry: The Milne Report and Inspection of Overseas Meat Plants', in David F. Smith and Jim Philips (eds.), *Food, Science, Policy and Regulation in the Twentieth Century. International and Comparative Perspectives* (London and New York: Routledge, 2000).
[103] Cf. Smith et al., *Food Poisoning, Policy and Politics. Corned Beef and Typhoid in Britain in the 1960s*, p. 22.

which made experts perceive antibiotic resistance as a static phenomenon.[104] With new antibiotics still entering the market, emerging and existent resistance was deemed controllable. However, in 1965, E. S. Anderson and Naomi Datta challenged this view with a paper titled *Resistance to Pencillins And Its Transfer In Enterobacteriaceae* in the *Lancet.*[105] In their paper, the authors discussed the 'horizontal' communication of antibiotic-resistance via plasmids in the case of *Salmonella typhimurium.* Instead of merely passing on resistance to subsequent generations, bacteria could exchange blueprints for antibiotic resistance across species borders. Citing German and Japanese research, the authors warned about the possible transfer of resistance between *S. typhimurium* and *Escherichia coli* bacteria. For the authors, it was clear that feeding antibiotics to animals could lead to human infections caused by antibiotic-resistant *S. typhimurium* – a close relative of the typhoid-causing *S. typhi.*[106]

Three months later, Anderson followed up his findings with another paper published together with M. J. Lewis in *Nature*.[107] Reporting a dramatic rise of *S. typhimurium* resistance between 1963 and 1964, the authors specifically focused on the particularly resistant type 29 of the bacterium. Linking the spread of type 29 *S. typhimurium* to calf transports, the authors went on to warn against the "infective hazards of intensive farming."[108] By the end of the year, Anderson published an even more direct attack on agricultural antibiotics in the *British Medical Journal*: having advised officials during the Aberdeen typhoid-outbreak,[109] Anderson had subsequently collected over 1.200 animal (mainly calf) and 500 human samples of type 29 *S. typhimurium* between December 1964 and November 1965. Out of these samples, 97.6 per cent proved to be drug-resistant.[110] However, in contrast to earlier papers, Anderson was now able to demonstrate a case of resistance transfer from animals to humans: human and

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[104] Cf. Christoph Gradmann, 'Sensitive Matters: The World Health Organisation and Antibiotic Resistance Testing, 1945-1975', *Social History of Medicine,* 26/3 (2013), pp. 556-60.
[105] E. S. Anderson and Naomi Datta, 'Resistance to Pencillins and Its Transfer in Enterobacteriaceae', *The Lancet,* 285/7382 (1965).
[106] Cf. Ibid.
[107] E. S. Anderson and M. J. Lewis, 'Drug Resistance and Its Transfer in Salmonella Typhimurium', *Nature,* 206/4984 (1965).
[108] Ibid., p. 583.
[109] Cf. Smith et al., *Food Poisoning, Policy and Politics. Corned Beef and Typhoid in Britain in the 1960s*, pp. 85-87; 132.
[110] E. S. Anderson, 'Origin of Transferable Drug-Resistance Factors in the Enterobacteriaceae', *British Medical Journal,* 2/5473 (1965), p. 1289.

animal *S. typhimurium* samples showed similar resistance levels to furazolidone, a drug used exclusively in veterinary medicine. The resistance had clearly crossed over from animals to humans. Anderson was certain that out of the analysed samples "most human infections of undetermined source were bovine in origin."[111]

Published in quick succession, Anderson's warnings received widespread public attention. In February 1965, the *Times* informed readers about Anderson's first paper and suggested "that antibiotics should be kept well away from livestock food."[112] In November, the *Observer* blamed "super-farms"[113] for new resistances. Following Anderson's paper in the *British Medical Journal* in early 1966, the science sections of the *Times* and *Observer* reported on the "'infectious' risk"[114] emanating from farms. While the *Times* demanded a "reappraisal of the use of antibiotics"[115], the *Observer* published an appeal by the Farmers' and Smallholders' Association criticizing intensive agriculture's dangerous antibiotic-dependence.[116] In this context, the *Observer's* use of language is telling: warning against "factory farm bacteria"[117], the newspaper linked the discussion about 'infective' resistance to the rhetoric of *Animal Machines*.[118]

Faced with growing public pressure, the British government reconvened its committee on agricultural antibiotics. Once more headed by Lord Netherthorpe, the second Netherthorpe committee sat for several sessions following April 1965. In January 1966, the Netherthorpe committee called for a new committee to re-evaluate agricultural antibiotics in general.[119] While the government was slow to react, criticism of agricultural antibiotics did not leave British headlines. As Robert Bud has shown, the enduring media attention was

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111 Ibid.
112 'Germ Survival in Face of Antibiotics', *Times*, 26.02.1965, p. 15.
113 John Davy, 'New health fear on super-farms', *Observer*, 28.11.1965, p. 5; a further report on Anderson's work appeared two months later: 'Warning on factory-farm bacteria', *Observer*, 30.01.1966, p. 4.
114 'Warning on factory-farm bacteria', *Observer*, 30.01.1966, p. 4.
115 'Reconsidering Use Of Antibiotics', *Times*, 28.02.1966, p. 13.
116 Cf. 'Stop use of hormones', *Observer*, 30.01.1966, p. 4.
117 'Warning on factory-farm bacteria', *Observer*, 30.01.1966, p. 4.
118 Cf. also readers' responses linking factory farms, the omission of the Brambell Committee and antibiotic resistance: Valerie Crofts, 'Letters to the Editor: Factory Farming', *Observer*, 06.02.1966, p. 30; Margaret Cooper, 'Letters to the Editor: Factory Farming', *Observer*, 06.02.1966, p. 30.
119 R. Braude, 'Antibiotics in Animal Feeds in Great Britain', *Journal of Animal Science,* 46 (1978), p. 1427, Bud, *Penicillin: Triumph and Tragedy*, pp. 177-81.

partly due to the efforts of the *Guardian*'s Anthony Tucker and Bernard Dixon from the *New Scientist*.[120] While MPs called for further action in parliament,[121] Dixon attacked "the irritating British habit of seeking expert guidance on a technical matter and then pigeon-holing the advice when it comes."[122] Citing Anderson's work, Dixon also referred to the danger of multi-resistant *E. Coli* strains causing neonatal diarrhoea in babies.[123] By December 1967, Dixon's warnings sounded tragically prophetic. Described by Robert Bud in chilling detail, resistant *E. coli* caused a severe outbreak of gastroenteritis amongst infants in the north-eastern town of Middlesbrough. Poor hospital hygiene and transferring infected infants to other hospitals spread the infection. In the end, 15 infants died.[124] While there was no way of linking their origin to farms, the Teesside strains of *E. coli* 0119 and 0128 were resistant to ampicillin, terramycin, tetracycline, neomycin, kanamycin, the sulphonamides and chloramphenicol.[125]

Pre-conditioned by the vocabulary of *Animal Machines,* British readers nonetheless linked the resistant Teesside strains to agricultural antibiotics' new 'factory farm' image. Writing to *The Illustrated London News* in late 1967, Gwendolen Barter declared that one should forego factory farm meat if "one values one's health."[126] By contrast, N. S. Barron, a veterinary science lecturer from Reading University, claimed that physicians and not farmers were to blame for spreading salmonella.[127] Responding to Barron, Robert Waller, the editor of the Soil Association's journal, and J. Bower from the Farm & Food Society

[120] Cf. Bud, *Penicillin: Triumph and Tragedy*, pp. 177-81.
[121] Cf. TNA MAF 284/282 (P.Q. Mr. John Harr (Harborough), Oral, 26 Jul, 1967); TNA MAF 287/450 (House of Commons, Written Answer, Treatment of Human Infections, Exclusive Use of Certain Antibiotics, No.84/1967/68, 13 Nov, 1967)
[122] Bernhard Dixon, 'Antibiotics on the farm – major threat to human health', *New Scientist* (05.10.1967), p. 33.
[123] Ibid., p. 34.
[124] Cf. Bud, *Penicillin: Triumph and Tragedy*, pp. 178-81.; regarding the fatality numbers; cf. House of Commons Debate 11.04.1968 vol. 762 cc1619-30, 'Gastro-Enteritis (Tees-Side) Hc Deb 11 April 1968 Vol 762 Cc1619-30', *Digitised editions of Commons and Lords Hansard, the Official Report of debates in Parliament*; URL: <http://hansard.millbanksystems.com/commons/1968/apr/11/gastro-enteritis-tees-side>, (accessed 24.02.2013).
[125] Cf. FD 7/899 (T.B. Williamson to J. Hensley, Attached: Background Notes (PQ.43), 25 Jan, 1968), p. 1.
[126] Gwendolen Barter, 'Letters to the Editor: Ethics and cruelty', *London Illustrated News,* 18.11.1967, p. 6.
[127] Cf. N. S. Barron, 'Letters to the Editor: Factory Farming', *London Illustrated News*, 09.12.1967, p. 6.

accused him of downplaying the dangers of antibiotics and intensive farming.[128] Writing from Sussex, another reader confessed feeling "uneasy"[129] by Barron's apparently biased defence of antibiotics and the factory farming system. Reacting to readers' controversy, the *London Illustrated News* published a long article blaming the use of agricultural antibiotics for the Teesside epidemic:

> … one cannot help wondering why man should take the chance of placing himself in danger of returning to conditions of the pre-antibiotic era when, for example, the death of fourteen babies from gastro-enteritis would certainly not have made news headlines.[130]

The Teesside epidemic put immense pressure on the British government to implement the Netherthorpe-suggestions and combat antibiotic-resistance.[131] Appointed in July 1968 and announcing its findings in November 1969, the Joint Committee on the use of antibiotics in animal husbandry and veterinary medicine – the so-called Swann-Committee – divided antimicrobial substances into therapeutic and nontherapeutic antibiotics.[132] While therapeutic antibiotics were relevant to human medicine, nontherapeutic antibiotics were considered irrelevant. Only nontherapeutic antibiotics below certain doses were to be allowed in standard animal rations. Relevant therapeutic substances such as penicillin, chlortetracycline and oxytetracycline were to be banned from feed substances. The committee also cautioned against the use of chloramphenicol in animal feeds but did not recommend a ban. Furthermore, the committee did not limit veterinarians' power to prescribe therapeutic antibiotics on a prophylactic or metaphylactic basis.[133]

However, media reactions to the report were mostly favourable. In the *Guardian*, Anthony Tucker welcomed the end of agricultural antibiotics' indiscriminate use but worried about the Swann committee's narrow focus.[134] In

[128] Cf. Robert Waller, 'Letters to the Editor: Factory Farming', *London Illustrated news*, 30.12.1967, p. 4; J. Bower, 'Letters to the Editor: Spread of infection', *London Illustrated News*, 20.01.1968, p. 31.
[129] F. Belsham, 'Letters to the Editor: High-pressure farming', *London Illustrated News*, 03.02.1968, p. 6.
[130] Tony Loftas, 'How Do Germs Learn To Resist Drugs', *London Illustrated News*, 27.01.1968, p. 17.
[131] Bud, *Penicillin: Triumph and Tragedy*, p. 181.
[132] Braude, 'Antibiotics in Animal Feeds in Great Britain', p. 1427.
[133] Cf. Leonard Amey, 'Three antibiotics banned from animal food', *Times*, 21.11.1969, p. 2.
[134] Cf. Anthony Tucker, 'Antibiotics to be banned from animal feeds', *Guardian*, 21.11.1969, p. 20.

an editorial with the derogative title "What are we going to feed 'em?"[135], the *Times* lauded the decision to limit lay-farmers' access to therapeutic substances and entrust them to veterinarians. However, the newspaper's agricultural correspondent, Leonard Amey, was critical of veterinarians' increased power over farmers.[136] While agreeing with the Swann recommendations in principal, Amey sagely noted that a complete ban of agricultural antibiotics would have put an end to conventional intensive animal production in Britain.[137] Indeed, by 1969, expanding British farmers had become highly dependant on access to the former 'miracle drugs'. However, the historical trajectory of this dependency was not straightforward.

[135] 'What Are We Going To Feed 'Em?', *Times*, 21.11.1969, p. 11.
[136] Cf. Leonard Amey, 'A week of many moves', *Times*, 24.11.1969, p. 18.
[137] Cf. Leonard Amey, 'Rapid action on farm antibiotics', *Times*, 10.11.1969, p. 1.

British Agriculture

During the early 1930s, the outlook for British farming had seemed particularly bleak: as inhabitants of the largest agricultural free-trade market in the world, British farmers were exposed to sinking food prices and an onslaught of foreign imports during the global agricultural crisis.[138] Unable to compete with cheap imports, employment in the agricultural sector fell and productivity decreased until 60% of British food had to be imported.[139]

Concerned about the demise of rural areas, the British government abandoned its traditional *laissez-faire* philosophy: the Agricultural Acts of 1931 and 1933 saw the creation of tariff walls and corporatist Marketing Boards for farm products.[140] Reacting to growing international tensions, the government set up a Food Department in 1936 and began stockpiling food and agricultural supplies. By 1939, British officials were actively propagating agricultural expansion to provide additional calories.[141] Following the outbreak of war, the new alliance between farmers and officials grew even closer: farmers were integrated into county-based War Agricultural Executive Committees (WAEC), which were controlled by the Ministries of Agriculture and Food. At the local level, the WAECs enforced ministry directives but also advised and graded farmers' productivity. Significantly, unproductive or recalcitrant farmers could be expropriated. Attempting to maximize caloric output, [142] the wartime administration not only prioritised plant production but also introduced guaranteed prices by purchasing farmers' produce.[143] While pig and poultry stocks plummeted, farmers managed to increase caloric output by 50%.[144]

After the Second World War, British farmers were thus credited with 'feeding the nation' in a time of crisis. However, the wartime doctrine of growth and efficiency had led to changes in the very fabric of British farming. According to John Martin, traditional rural values had been substituted "for short term

[138] Cf. John Martin, *The Development of Modern Agriculture. British Farming since 1931* (London et al. : MacMillan & St. Martin's Press, 2000), pp. 6-8.
[139] Ibid., p. 10.
[140] Cf. Ibid., p. 23.
[141] Cf. Ibid., pp. 29 and 33-35.
[142] Ibid., p. 51.
[143] Ibid., p. 38.
[144] Ibid., p. 54.

economic advantages and unquestioning compliance."[145] Nonetheless, the majority of post-war farmers and their lobby, the NFU, were eager to continue their corporatist alliance with the state. In contrast to the poverty-stricken inter-war years, most farmers' coffers had been flushed by fixed wartime prices and subsidised intensification. Meanwhile, the general economic situation made the Labour government equally willing to continue the alliance. During the early post-war years, the Attlee government struggled to stem the costs of decommissioning large parts of the British military while rebuilding industry. Furthermore, the termination of the Lend-Lease agreement with the United States in August 1945 necessitated the repayment of American wartime loans and left Britain desperately short of foreign currency.

Attempting to reduce imports, the British government embarked on a program of subsidized and state-controlled agricultural expansion with the Agricultural Act of 1947. Perpetuating annual price reviews and intervention purchases, the act was designed to give farmers and farm workers fair returns and stimulate agricultural investment in expansion.[146] Meanwhile, the government attempted to boost efficiency by founding the National Agricultural Advisory Service (NAAS) and providing farm improvement grants.[147]

In spite of growing international food availability and the end of rationing in 1954, state-involvement in agriculture continued.[148] Ignoring accusations of 'feather bedding' farmers,[149] successive governments supported a system of 'deficiency' payments, which substituted former direct intervention purchases: once market prices fell below guaranteed prices defined by annual price reviews, the state paid farmers the difference between guaranteed and real prices. However, sinking international food prices and domestic surpluses soon made the cost of state intervention rise dramatically. Attempting to curb expenditure,

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[145] Ibid., p. 61.
[146] Cf. B. A. Holderness, *British Agriculture since 1945* (Manchester: Manchester University Press, 1985), pp. 12-16.
[147] Martin, *The Development of Modern Agriculture. British Farming since 1931*, pp. 91-92.
[148] Agriculture serves as a particularly good example for David Edgerton's theory on the continuities between interwar and post-war Britain; cf. David Edgerton, *Warfare State. Britain, 1920-1970* (Cambridge: Cambridge University Press, 2006).
[149] The comment was made in 1951 by MP Stanley Evans, Labour, then Parliamentary Secretary of the Ministry of Food; Francis Michael Longstreth Thompson (ed.), *The Cambridge Social History of Britain 1750-1950. Volume 1: Regions and Communities* (Cambridge: Cambridge Unviersity Press, 1990), pp. 148-49.

the Conservative government's 1957 Agricultural Act allowed annual reductions of price guarantees by up to 2.5 per cent and shifted the emphasis from subsidies to improvement grants.[150] However, the underlying corporatist principle of fostering agricultural growth and British self-sufficiency was not questioned.[151]

Trusting official subsidy promises, farmers throughout Britain invested wartime earnings and borrowed heavily to expand and improve their farms.[152] Farmers' magazines like the popular *Farmers Weekly* and the NFU's organ *British Farmer* were full of expert advice on new husbandry methods and basic economics for expanding farmers.[153] Serving as an important forum for campaigns against bovine tuberculosis and brucellosis,[154] the magazines also reported on new technologies like artificial insemination, growth promotion and airborne crop dusting.[155] Reinterpreting the trope of having 'fed the nation at war', popular scenarios of global overpopulation were deemed to justify subsidised agriculture.[156] Declared dead around 1930, British agriculture seemed ready to take on new challenges in the age of the atom. As a

[150] Holderness, *British Agriculture since 1945*, p. 21.
[151] On corporatism in British farming see especially Graham Cox, Philip Lowe, and Michael Winter, 'From State Direction to Self Regulation: The Historical Development of Corporatism in British Agriculture', *Policy and Politics,* 14/4 (1986), pp. 480-88.
[152] Cf. 'Heavy Borrowing From Banks', *FW* XXXIII/14 (06.10.1950), p. 40; cf. also: 'Millions More Spent On Buildings', *FW* XXXIII/15 (13.10.1950), p. 36; 'Farms Sell More – And Buy More Feed Fertiliser', *FW* XLIII/2 (15.07.1955), p. 68.
[153] Cf. 'Men and Machines', *FW* XXXIII/19 (10.11.1950), p. 31; 'Cows kept in all year', *FW* XLII/20 (20.05.1955), p. 93.
[154] Cf. 'Non-T.T. Farmers May Pay Dearly', *FW* XXXIII/25 (25.12.1950), p. 28; 'Going T.T. in 1951?', *FW* XXXIV/1 (05.01.1951), p. 33; Abigail Woods has published in great detail on 19th and 20th century animal health and disease eradication campaigns in Britain; cf. Abigail Woods, 'Why Slaughter? The Cultural Dimensions of Britain's Foot and Mouth Disease Control Policy, 1892-2001', *Journal of Agricultural and Environmental Ethics,* 17 (2004), Abigail Woods, ',Partnership' in Action: Contagious Abortion and the Governance of Livestock Disease in Britain, 1885-1921', *Minerva,* 47 (2009).
[155] Cf. ,AI Progress', *FW* XXXIII/25 (22.12.1950), p. 23; 'AI Museum With Semen Kept For 100 Years', *FW* XLII/18 (06.05.1955), p. 49; 'Quicker Fattening', *FW* XXXIII/22 (01.12.1950), p. 34; 'Feeding Stilboestrol for Fattening Cattle', *FW* XLII/20 (20.05.1955), p. 93. C.S. Smith, 'Pilot versus Pest', *FW* XXXIV/16 (20.04.1951), p. 59; Anthony Parkin, ,Farming's Share In The Peaceful Atom', *FW* XLII/10 (09.09.1955), p. 85.
[156] Cf. 'Filling the Meat Gap', *FW* XXXIII/22 (01.12.1950), p. 33; 'Farm Output Doubled', *FW* XXXIV/9 (02.03.1951), p. 43; 'World Output of Food is Up By a Quarter', *FW* XLIII/11 (16.09.1955), p. 76; 'The Farmers Weekly 21st Birthday Number', *FW* XLII/26 (01.07.1955), pp. 53 and 55; cf. also A. Winegarten, 'Twenty-one Years that Exploded the Cheap Food Myth', *FW* XLII/26 (01.07.1955), p. 99.

consequence, technological sophistication became an agricultural badge of pride – especially, when in comparison with smaller continental farmers.[157]

Profiting from soaring demand, intensification was a particularly important theme for livestock farmers – even if this meant less '"fuss"[158] about individual animals. The motto of most articles could be summarised as "never farm backwards."[159] One article claimed that while "nature intended a bird to lay only 24 eggs a season", scientific nutrition and husbandry meant that "there [was] no reason why she should not reach the 300 mark."[160] Frequently reminded to "treat the cow as a manufacturing unit,"[161] producers found it hard to resist "the urge to E-X-P-A-N-D":[162] Between 1948 and 1958, the number of farms below 300 acres decreased rapidly, while the number of farms over this threshold increased steadily.[163] While Britain produced 762.000 tonnes of meat in 1947, it produced 1,713,000 tonnes in 1960.[164]

However, a minority of farmers remained apprehensive about agricultural intensification.[165] A few commentators feared that improved efficiency would increase the socio-cultural divide between a shrinking number of farmers and the general public.[166] At the same time, some farmers remained wary of new technologies. According to John Martin, the unpopularity of British college- or university-based agricultural education caused an "innate opposition (…) to scientific and technical learning."[167] Many farmers continued to believe in the wholesomeness of 'natural environments' and feared technological alienation from animals and nature. Advocating the curative powers of fresh air, Anthony Phelps defended his free-range system in 1955*:*

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[157] Cf. ‚Tribute to Britain', *FW* XXXIII/20 (17.11.1950), p. 28; cf. Also: ‚British Tractors Work Hardest', ibid., p. 36; Hilary Philips, 'Expedition to Lorraine', *FW* XXXIII/14 (06.10.1950), p. 70.
[158] H.L. Blackwell, 'Poultry 'Sense'', *FW* XXXIII/16 (20.10.1950), p. 77; cf. also James Scott Walson, 'High Production per Acre Is The Aim', *FW* XXXIV/2 (12.01.1951), pp. 34-35.
[159] Jack Hargreaves, 'Never Farm Backwards', *FW* XLII/25 (01.07.1955), pp. 118-119 and 121-122.
[160] Alexander Tomey, 'Not All Her Own Work', *FW* XXXIII/17 (27.10.1950), p. 65.
[161] Dr. A. Stewart, 'Treat the Cow as Manufacturing Unit', *FW* XLIII/13 (30.09.1955), p. 48.
[162] 'The Urge to E-X-P-A-N-D', *FW* LIII/10 (02.09.1960), p. 48; cf. also 'Mass Production', *British Famer* [in the following: *BF*] No.256 (20.101.1962), p. 3.
[163] Ibid.
[164] Europe: Meat Output Statistics, in: Palgrave Macmillan, 'International Historical Statistics', (Palgrave Macmillan, April 2013).
[165] Cf. 'Blinkered', *FW* XXXIV/5 (02.02.1951), p. 26.
[166] A.G. Street, 'Rises Without Strikes', *FW* XXXIII/15 (13.10.1950), p. 49.
[167] Martin, *The Development of Modern Agriculture. British Farming since 1931*, p. 93.

> … six poultrymen who have visited me in the last three months have all said the same thing, almost in the same words: 'You cannot make free range egg production pay.' Those six poultrymen were all old hands in the game – old enough to remember the pre-deep litter era – and they included an Advisory officer and two members of the advisory staffs of various feedingstuff manufacturers. They were all wrong.[168]

Curiously, one of the most powerful statements against intensification was a children's story written by Derek Chapman and published in *Farmers Weekly* in 1950. Titled "Battery Lucy and Three-Oh-One"[169], Chapman's story features a first-person narrator, who works inside an intensive battery egg facility. At work, the narrator meets Lucy, a "Rhode Island Red Light Sussex cross".[170] While the narrator's initial affection for the standardised mass of animals "slowly ripen[s] into contempt," Lucy's individuality and her hour-glass shaped eggs lead him to reflect on the differences between animals and humans:

> Now people will tell you – people like anthropologists, that is, and zoologists and psychiatrists and the other kind – that the difference between Man and Brute Beast (…) is that Man is a Reasoning Animal. (…). None of us cares to be compared with the beasts, unless it be to their disadvantage, but honesty bids me be humble and say the truth. Lucy was equal to you and me (…): Lucy was a reasoning animal.[171]

Worried about Lucy, who is exposed to the vicious attacks of her neighbour – a Boadicea-like chicken called 301 –, the narrator approaches Lucy's owner:

> I think he was incapable of favouritism or sentiment towards any of his charges. To him each was a cog in the wheel, tolerable only so long as it played a demonstrable part. The owner was young – not exactly straight from his agricultural college, although the ink on his diploma hadn't begun to fade, but still young enough to do everything by the book. Efficiency was his brief motto.[172]

A manager of modern 'animal machines', the young chicken-producer refuses to help or sell Lucy. With Lucy laying fewer eggs and threatened by culling, the narrator decides to save her. After a dramatic scene in which Lucy turns into a cockerel and kills her aggressive neighbour, the narrator smuggles her out of the

[168] Anthony Phelps, 'There's Still Money in Free Range', *FW* XLIII/5 (05.08.1955), p. 85; cf. also "Nobody asked if she minded", *FW* XLIII/5 (05.08.1955), pp. 74-75.
[169] Derek Chapman: Battery Lucy and Three-Oh-One', *FW* XXXIII/16 (20.10.1950), p. 82.
[170] Ibid.
[171] Ibid.
[172] Ibid.

factory-like farm. Although he looses his job and is sued by Lucy's owner, the narrator ends his account by describing Lucy's happy life in his back garden. Maintaining their individuality and 'humanity' in the face of agricultural industrialisation, Lucy and the narrator re-establish a little pocket of idealised rural past in a back garden free of economic constraints.[173]

Adding to concerns about new technologies, other critics warned about possible health hazards. In 1955, J. Worthington advocated feeding so-called greenfood to hens and using their manure to fertilise fields:

> Oh, I know that this is the age of *ersatz*, that mashes and pellets are reputed to be complete. (…). There is more in nutrition than chemistry. (…). Nowadays it is so much easier to buy drugs. (…) I do not know. I rely on greenfood to keep my chicks free from coccidiosis.[174]

At the 1955 British Veterinary Congress, the deputy director of the government's Veterinary Laboratory in Weybridge, Dr E.L. Taylor, warned "that man has initiated a whole host of major troubles."[175] In accordance to these troubles, Taylor divided his talk into five sections: "'Unnatural Foods', 'Unnatural Environment', 'Unnatural Concentration of Grazing Animals', 'Unnatural Geographical Position' and 'Unnatural Animals'."[176] In the same edition of *Farmers Weekly*, Taylor also claimed that modern hygiene and "supercilious dislike of some creatures and conditions (…) upset the whole delicate compensatory mechanism of nature."[177]

In spite of internal navel-gazing, British farmers often reacted hostile to criticism voiced outside of agricultural circles. As one letter put it in 1955: "We as farmers are told what to do and when to do it by every Tom, Dick and Harry."[178] A particularly sensitive topic was animal welfare. While most farmers defined welfare as animals' continued productivity, the British public was extending its definition of welfare to animals' mental wellbeing.[179] Titled "Broiler

[173] Cf. Ibid, p. 83.
[174] J. Worthington, 'A Little Of What They Fancy', *FW* XLL/19 (13.05.1955), p. 101.
[175] 'British Veterinary Congress. 'Has Man Put Animals' Health In The Balance?', *FW* XLIII/11 (16.09.1955), p. 76.
[176] Ibid.
[177] 'Animal Crackers', *FW* XLIII/11 (16.09.1955), p. 46; cf. also 'Kill turkeys needing drugs', *FW* LIII/2 (08.07.1960), p. 49.
[178] D.W. Murrell, 'Letter to the Editor', FW Vol. XLIII No. 9 (02.09.1955), p. 39.
[179] Cf. Abigail Woods, 'From Cruelty to Welfare: The Emergence of Farm Animal Welfare in Britain, 1964-71', *Endeavour* 36/1 (2012), p. 21.

Veal Not Cruel – Says NFU"[180], "Calves don't suffer – Mr. Hare"[181] and "Cruel to their Kind?"[182], articles in farming journals attempted to defend intensive systems with the help of expert studies and references to high British standards.[183] In comparison to the "pot-bellied" pre-war animals "with staring coats, housed in filthy hovels,"[184] agricultural commentators asserted that intensive systems offered modern animals a much better life. According to *Farmers Weekly* columnist A.G. Street:

> The charge that such intensive methods of fattening are cruel springs from the inevitable difference between the definition of 'cruelty' according to whether one is country or town bred. To the former – and especially the farmer – cruelty is ill-treatment, especially to the extent that the health and thriving of the animal is adversely affected. But the latter usually add to this what they call lack of consideration. Rightly or wrongly – I think wrongly – townsfolk are apt to invest dumb animals with human minds and hopes and emotions.[185]

Thrown into the maelstrom of post-war intensification, British farmers were torn between the promise of progress and an idealised rural past. While reports about technological risks made farmers wary, farmers also felt isolated and misunderstood in the face of public criticism. As a consequence, most farmers adopted a hybrid position somewhere between the polar extremes of intensification and tradition – modernisation was always negotiation.

Antibiotics were a case in point. Spared many wartime constraints, dairy farmers belonged to the vanguard of antibiotic-users. Indeed, penicillin was soon used to gloss over many of the dairy sector's intensification problems. Since the late 1940s, veterinarians and farmers had used penicillin to treat mastitis. Although mastitis had long been a problem, the increasing use of mechanical teat suction cups for milking spread the disease due to inadequate sterilisation and udder-injuries. By the early 1950s, many farmers relied on so-called dry-cow

[180] 'Broiler Veal Not Cruel – says NFU', FW LIII/4 (22.07.1960), p. 38.
[181] 'Calves don't suffer – Mr Hare', FW LIII/5 (29.07.1960), p. 40.
[182] A.G. Street, 'Cruel to their Kind?', FW LIII/14 (30.09.1960), p. 83.
[183] Cf. 'P.J. Sandison, 'What Suits Calves…', FW LIII/5 (29.07.1960), pp. 62.-63; Broiler Veal Not Cruel – says NFU', FW LIII/4 (22.07.1960), p. 38
[184] A.G. Street, 'Cruel to their Kind?', *FW* LIII/14 (30.09.1960), p. 83.; cf. also: Middleton Sherrif, 'Neglected Study – Does a farmer always know best?', *FW* LIII/17 (21.101.1960), p. 107.
[185] A.G. Street, 'Cruel to their Kind?', *FW* LIII/14 (30.09.1960), p. 83.

therapy in which sulphanilamide or penicillin udder-injections were given prophylactically at the end of cows' lactation periods.[186]

Relying on dry-cow therapy, British farmers were, however, fully aware of concommitant problems. In 1951, lengthy articles in *Farmers Weekly* warned about penicillin-residues in milk: "rejection of milk from cows undergoing treatment with penicillin is the only safe course so far as cheese manufacture is concerned."[187] In order for cheese curd to work, penicillin residues had to stay below 0.1 units of penicillin per millilitre of milk – a minimum of two milkings had to be discarded following penicillin-use.[188] In the same year, veterinarians also reported a "changing 'clinical picture' which might follow the extensive use of penicillin." [189] As a consequence, they advised against "a too great a dependence on that drug:"[190]

> One should be warned against the tendency of many farmers to think that penicillin [is] the be-all and end-all of the mastitis problem. (…). The time [has] come for more research into the development of resistant strains and how they [can] be avoided.[191]

Whereas *Streptococcus agalactiae* had caused 44 per cent of mastitis-outbreaks in 1944, its successful treatment with penicillin had enabled penicillin-resistant haemolytic *Staphylococci* to take over. Between 1944 and 1955, the percentage of mastitis-outbreaks caused by *Staphylococci* rose from 10 to 30 per cent.[192] Faced with these reports, some dairy farmers were reluctant to allow drugs near their cows at all. Advocating a health regime based on Epsom salts, one reader speculated: "normally a balance is maintained between the infective bacteria and the antibodies in the milk (…). The free use of antibiotics reduces the vigour of antibodies so that the cow is more prone to infection."[193]

However, the majority of dairy farmers believed that antibiotics' benefits continued to outweigh potential costs and adhered to the common belief that

[186] 'Questions Section: Summer Mastitis', *FW* XXXIII/17 (27.10.1950), p. 69.
[187] 'Penicillin Spoils Milk For Cheese-Making', *FW* XXXIV/1 (05.01.1951), p. 32.
[188] Cf. Ibid.
[189] 'Can Stockmanship Replace Dairy Hygiene?', *FW* XXXIV/10 (09.03.1951), p. 41.
[190] Ibid.
[191] Ibid. .; more hygiene surrounding the use of the machines was, however, repeatedly stressed throughout the next decades, 'Avoiding Mastitis', *FW* XLII/24 (17.06.1955), p. 103.
[192] Cf. 'Is there a new Mastitis Menace', *FW* XLIII/1 (08.07.1955), p. 47.
[193] Graham Brooks, ' Balance Prevents Mastitis', *FW* LIII/17 (21.10.1960) , p. 50.

known and unknown risks could be rendered manageable by technological safeguards and practitioners' education.[194] While commentators focused on improving hygiene and management practices, they did not fundamentally question the benefits of mechanisation or the general use of antibiotics.[195] Meanwhile, veterinarians used resistance to legitimize their profitable control over easy-to-use dry-cow preparations and lambasted American farmers' "indiscriminate use of antibiotics (…) without any veterinary supervision."[196]

Trust in future fixes also characterised the adoption of growth-promoting antibiotic feeds. Ahead of the 1953 TSA, the NFU was mostly concerned with lobbying for guaranteed minimum antibiotic concentrations in feeds and official guidelines for safe and efficient antibiotic-use.[197] With no internal expertise on antibiotics, the union relied heavily on information supplied by the state. As a consequence, government experts played a crucial role in convincing initially cautious farmers to use antibiotics. Following a 1953 meeting, the NFU representative thanked officials:

> The subject was one about which he and many other farmers were relatively ignorant and he was grateful for the information and advice given. He was in general agreement (…), but felt that caution in propaganda and in the use of antibiotics was necessary...[198]

Following their introduction in late 1953, sales of antibiotic feeds skyrocketed: in 1954, an estimated 69,439 tons of supplemented feeds were sold directly from manufacturers to farmers. By 1959, the number had grown by over

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[194] Cf. A great deal has been written on the role of technology, risk management and agricultural expansion in the 1930s-1960s with basically all of the English-speaking literature focussing on the US; cf. Deborah Fitzgerald, *Every Farm a Factory. The Industrial Ideal in American Agriculture* (New Haven and London: Yale University Press, 2003), J. L. Anderson, *Industrializing the Corn Belt. Agriculture, Technology and Environment, 1942-1972* (Dekalb: Northern Illinois University Press, 2009), Alan L. Olmstead and Paul W. Rhode, *Creating Abundance. Biological Innovation and American Agricultural Development* (Cambridge et al.: Cambridge University Press, 2008), Arwen P. Mohun, *Risk. Negotiating Safety in American Society* (Baltimore: Johns Hopkins University Press, 2013).

[195] Cf. 'Our Dairymen's Hygiene Shocks an Australian', *FW* XLIII/11 (16.09.1955), p. 57; 'British Veterinary Congress', *FW* XLIII/11(16.09.1955), p. 76.

[196] T. Cornell Green, 'More Milk – More Mastitis', *FW* XLIII/16 (21.10.1955), p. 99; cf. also Dr. R.F. Goodwin, 'Intensive way needs specialist vets', *FW* LIII/19 (04.11.1960), p. 58.

[197] Cf. TNA, MAF 287/299 (Dugdale to Turner, 29 July, 1953), p. 1 and TNA MAF 287/299 (Draft Regulation Therapeutic Substances Bill, Meeting, 3rd July, 1953).

[198] TNA MAF 287/299 (G. Hedley; Meeting at Saughton to discuss TSA draft regulations, 4 February 1953), p. 4.

600% to 445,706 tons.[199] On farms, antibiotic feeds' impact was equally dramatic and changed biological rhythms at the very heart of traditional husbandry: instead of weaning piglets 56 days after birth, farmers were now advised to wean 24-28 hour old piglets and feed them penicillin-enriched milk powder. This way, even runts would survive and piglets would weigh ca. 40 lb. at their traditional weaning age.[200]

Instead of bemoaning unnatural artifice, *Farmers Weekly* invoked an ideal of optimised nature. According to the magazine, agricultural antibiotics were a "boon to mankind."[201] Speaking at a symposium in Rome in 1955, an American nutritionist claimed that supplementing all European pig feeds with antibiotics would save more than 1,300 million lb. of pig food per year and provide 600 million lb. more pork.[202] Titled "Our debt to the Chemist,"[203] another article listed antibiotics, hormones, pesticides and insecticides amongst the great triumphs of 20th century science. [204] According to the general manager of Pfizer's new factory in Kent, antibiotic feeds enabled British farmers to market pigs three weeks sooner. With pigs requiring ca. 10 per cent less feed, 300,000 acres could be freed for growing other crops.[205]

Meanwhile, pharmaceutical companies used aggressive marketing to promote their products. Keeping with the technological optimism of the time, antibiotic commercials in agricultural magazines featured happy, talkative animals boasting about their tremendous weight gains, health and farmers' savings. Titled "Pigs can earn you more"[206] or "Cyfac Pigs are never a burden,"[207] antibiotic-commercials invoked an agrarian utopia of standardised, predictable and disease-free growth – the animal as a machine in an agricultural factory. According to a 1955 Terramycin commercial, antibiotics were "writing a new time-table for the pig farmer. (…). You cannot afford not to keep abreast of this

[199] TNA FD1/8226 (Office Note observations on aspects of the use of antibiotics supplied by the CAFSMNA (ARC 574/60), p. 1.
[200] Cf. 'Artificial Rearing of Pigs', *FW* XLII/19 (13.05.1955), p. 91.
[201] 'Antibiotics – Boon to Mankind', *FW* XLII/20 (20.05.1955), p. 45.
[202] Ibid.
[203] 'Our debt to the Chemist', *FW* XLII/26 (01.07.1955), p. 101.
[204] Ibid.
[205] 'Antibiotics Could Cut Pig Costs By Pound 5m A Year', *FW* XLIII/14 (07.10.1955), p. 44.
[206] 'Pfizer Commercial Terramycin', *FW* LIII/10 (02.09.1960), p. 74.
[207] 'Cyanamid Commercial Cyfac', *British Farmer* No. 616 (06.09.1969), p. 80.

most important feeding development for many years."[208] Titled, "Has it put your clock forward?"[209], the commercial featured a stopwatch, whose numbers had been substituted by increasingly large pigs. Fittingly, pigs' time was up once the pointer reached the minute mark in the form of a giant ham. In spite of British companies' patriotically-themed product promotion,[210] American dominance on the feed market was soon undeniable. By the end of the 1950s, most farmers would have been familiar with US feed brands like AUROFAC and Terramycin. In 1955, a Cyanamid commercial boasted:

> Last year, 1 in every 10 pigs in the United Kingdom had AUROFAC 2A Feed Supplement throughout its life (…). This year, 1 in every 7 pigs in the United Kingdom is being fed on AUROFAC 2A Feed Supplement from birth to slaughter.[211]

In contrast to mastitis medications, agricultural concerns about the safety of antibiotic feeds only emerged slowly. Surprised by the ARC's 1960 review announcement, *Farmers Weekly* was irritated that the report "condemns those willing to take risks for what it admits can be considerable gains."[212] However, for the most part, farmers were content to wait for the Netherthorpe Committee's decision. In the meantime, it was business as usual: although ways to reduce antibiotic-use were pointed out[213] and farmers were advised to keep "infection in hand,"[214] most articles continued to propagate generous antibiotic-use.[215] Reporting on antibiotic-use to counter "moments of stress", one article mused: "Is it surprising that the dosage of antibiotics constantly goes up and that coccidiosis remedies lose their potency after two or three years?"[216] However, two pages later, another article advised a farmer facing already resistant coccidiosis to "complain to your feed merchants of the poor results you are

[208] 'Pfizer Commercial Terramycin', *FW* XLII/19 (13.05.1955), p. 35.
[209] Ibid.
[210] Cf. 'ICI Commercial Promix', *FW* XLIII/2 (15.07.1955), p. 96;'Glaxo Commercial Vitablend', *FW* LVII/3 (20.07.1962), pp. 66-67.
[211] 'Cyanamid Commercial AUROFAC 2A', *FW* XLIII/16 (21.10.1955), p. 76.
[212] 'ARC', *FW* Vol. LIII No. 2 (08.07.1960), p. 46.
[213] Norman L Goodland, 'One-up – one down', *FW* LIII/7 (12.08.1960), p. 87.
[214] E.G. Harry, 'Infection In Hand', *FW* LIII/5 (29.07.1960), p. 73.
[215] Cf. 'Common Cold Cure', *FW* LIII/2 (08.07.1960), p. 109; cf. also: 'Shepherd's pocket vet', *FW* LIII/4 (22.07.1960), pp. xi-xiii; 'Cold or Worse', *FW* LIII/12 (16.09.1960), p. 133.
[216] 'Chickens Get the Needle', *FW* LIII/12 (16.09.1960), p. 129.

getting and perhaps change to some other kind of medicated food."[217] Similarly, most veterinarians remained unperturbed about subtherapeutic feeds: interviewed by *Farmers Weekly*, J.D. Blaxland from the Central Veterinary Laboratory in Weybridge admitted that "the almost universal use of drugs and antibiotics"[218] was causing problems but did not condemn their use.[219] During the 1950s, most farmers thus saw antibiotic resistance and residues as necessary evils alongside the road of agricultural intensification and progress.

While the 1962 Netherthorpe report seemed to legitimate such complacency,[220] the 1960s saw concerns about animal welfare, human health and conservationism merge into a broader environmental movement. Unsurprisingly, the agricultural community actively participated in the ensuing debates. However, instead of favouring monolithic growth, contributions to *Farmers Weekly* and *British Farmer* reveal an astonishingly open discussion about agricultural intensification and its side-effects.

On the one hand, both journals played host to staunchly expansionist reporting. In July 1964, *Farmers Weekly* proclaimed "a new 'golden age'" of growth and efficiency.[221] Meanwhile, *British Farmer* reported on growing markets for British meat[222] and called for an adoption of "mass-production techniques used in industry."[223] In this context, the agricultural press was particularly impressed by the poultry industry. Reporters wrote in awe about fully mechanised 8,000-bird laying houses, where hens and eggs were "untouched by hand."[224] Although meat markets were suffering from chronic over-saturation, experts continued to promulgate Malthusian threat scenarios and the need for efficient, antibiotic-dependent expansion.[225] Meanwhile,

[217] 'Bugs and Drugs', *FW* LIII/12 (16.09.1960), p. 131.
[218] 'Poultry troubles multiply with expansion', *FW* LIII/11 (09.09.1960), p. 57.
[219] Agricultural magazines frequently reported on new antibiotics ready to enter the market during the 1950s and 1960s; Cf. Ibid.; 'Latest Cocci Drugs on Trial', *FW* LIII/12 (16.09.1960), p. 129; 'Antibiotics for Keeping', *FW* LIII No. 22 (25.11.1960), p. 113.
[220] The report was so in tone with the prevailing view of antibiotics that it went unnoticed by the analysed agricultural press.
[221] 'A New 'Golden Age'', *FW* LXI/3 (17.07.1964), p. 31; cf. also 'It Must Be Growth', *FW* LX/3 (17.01.1964), p. 33; 'The Call Is For Growth', *FW* LX/2 (10.01.1964), p. 38; cf. 'Agricultural expansion ' a very good investment for the nation', *BF* No.542 (23.03.1968), p. 1.
[222] 'Meat', *BF* No.289 (01.06.1963), p. 3.
[223] 'Mass Production', *BF* No.256 (20.10.1962), p. 3; cf. also: 'Quicker Turnover', ibid.
[224] Anthony Lisle, 'Untouched by Hand', *FW* LVII/1 (06.07.1962), p. 99.
[225] Cf. A.K. Smith, 'Umbrella With The Blue Rosettes', *FW* LVII/3 (20.07.1962), pp. 87 and 89; 'Manpower At A Minimum', *FW* LVII/9 (31.08.1962), p. 93.; 'UK surplus for FAO food drive', *FW*

farmers were told to "gear up for the supermarket age" [226] via vertical integration.[227]

On the other hand, agricultural magazines provided a forum for critics of expansionism. Urging producers to focus on marketing, utilize market niches and pool resources,[228] commentators had to admit that many small farmers were unable to keep up with the financial and emotional burdens of constant expansion. Furthermore, the diminishing gap between producer and production prices inherently favoured larger farmers' economies-of-scale.[229] Between 1951 and 1971, the number of people working in British agriculture decreased from 1,142,000 to 740,000.[230] Having invested wartime profits into improvements during the 1950s, British farmers came to realise that the brave new world of industrial agriculture would only be open to a select few. Analysing the US in 1962, an article in *Farmers Weekly* predicted an "end in sight for the family farms."[231] By 1969, an older smallholder resignedly wrote: "Agriculture, like all other walks of life, is becoming a rat race and keeping up with the Joneses." [232]

Although most farmers were unwilling to morph into agricultural industrialists, proposed solutions differed greatly: arguing for further intensification, some commentators hoped that better contracts would save farmers from industrial "chains."[233] Meanwhile, others aimed to create "farms that will make a living"[234] by consolidating medium-sized farms. Hoping to save small farmers, other commentators wanted to limit agricultural firms' access to

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LVII/10 (07.09.1962), p. 51; 'War on Hunger', *BF* No.338 (02.05.1964), p. 8; 'World Famine Danger', *BF* No.484 (11.02.1967), p. 15; 'World Food Deficit', *BF* No.433 (12.02.1966), p. 82.
[226] W.G.R. Weeks, 'Gear up for the supermarket age', *FW* LVII/10 (07.09.1962), p. 91.
[227] Cf. E.P. Voelcker, 'Economies through integration – without chains', *FW* LX/3, supplement, (17.01.1964), p. 61.
[228] Cf. Rupert Coles, 'Points of Survival', *FW* LVII/7 (17.08.1962), p. 101; Paul Atlee, 'Nobody's Too Small', *FW* LVII/16 (19.10.1962), pp. 119 and 121; Frank Ellis, 'Put the farmer back in the poultry business', *FW* LVII/16 (19.10.1962), pp. 139 and 141; Tom Perry,' Hands off Farm Co-ops', *FW* LVII No. 19 (02.11.1962), p. 39.
[229] Cf. Ernest Jay, 'Pound 100 Million Income Claim', *FW* LX/2 (10.01.1964), p. 37.
[230] Economically Active Population By Major Industrial Groups UK, Macmillan, 'International Historical Statistics'., p. 28.
[231] 'End in sight for the family farms?', *FW* LVII/6 (10.08.1962), p. 41; cf. also: Robert Saunders, 'Cross-roads of vertical integration', *BF* No.283 (20.04.1963), p. 1.
[232] Roger Vickery, 'Small but worthwhile', *FW* LXXI/24 (12.12.1969), p. 32.
[233] E.P. Voelcker, 'Economies through integration – without chains', *FW* LX/3, supplement, (17.01.1964), p. 61.
[234] 'Creating farms that will make a living', *FW* LX/2 (10.01.1964), p. 38.

land.[235] In 1964, delegates clashed over a resolution to limit the size of British farms at the NFU's annual general meeting. According to the resolution, the NFU should negotiate for ways to "ensur[e] that production of agricultural commodities remains with the farming industry" and "draw a line between [agricultural factories] and what is traditional agriculture." [236] However, opposition was strong: according to W. Greenhow from Durham, "the resolution was in direct opposition to progress. Hens did not need green fields to run in these days. It was important that some products be produced intensively."[237] After a heated discussion, what would have been a small revolution was defeated by 174 to 128 votes.[238] For the rest of the decade, most commentators simply called on the state to solve the dilemma by subsidising both farmers' incomes and further expansion.[239]

With the agricultural community divided about its economic future, reactions to nascent environmentalism varied considerably. During the 1950s, *Farmers Weekly* had already hosted ideological battles between conventional experts and the fledgling organic community. [240] One decade later, small farmers' plight induced the magazine to inform readers about alternative farming. In the same year that it printed its first vegetarian recipes,[241] *Farmers Weekly* reported on Mr. Myall of Harmer Hill, who used 'natural' manure with great success but was "not dogmatic" [242] when it came to treating his animals with conventional methods. In another portrait, Jon Wells was presented as a sensible, yet unconventional 66-acre farmer: "Jon is no leisured farmer. (…). Nor is he slap-dash. The farm is an excellent compact unit."[243] What set the heavily bearded Jon apart from his neighbours was his focus on self-sufficiency and pure food: "I

[235] Cf. David Campbell, 'What are the Big Landlords Doing?' *FW* LXXI/24, supplement, (12.12.1969), p. ii; 'City money coming', *FW* LXXI/25 (19.12.1969), p. 24.
[236] ''Factory' Farming', *BF* No.327 (15.02.1964), p. 31.
[237] Ibid.
[238] Ibid.
[239] Cf. 'Farm incomes are in step – Mr. Soames', *FW* LX/4 (24.01.1964), p. 45; 'One hour less, 15 bob more', *FW* LXXI/20 (14.11.1969), p. 29; confronted with farming militants in the late 1960s, the NFU stressed the role of negotiations with the state so as not to alienate support and use "political realism, not demagogic exhibitionism"; cf. 'Opinion', *BF* No.548 (04.05.1968), p. 9.
[240] Cf. H.R. Gray, 'The artificial nightmare', *FW* XLIII/15 (14.10.1955), p. 93; Viscount Newport, 'Artificial Nightmare', *FW* XLIII/16 (21.10.1955), p. 49.
[241] Kathleen Thomas, 'Meals without Meat', *FW* LVII/19 (02.11.1962), p. 105.
[242] Paul Atlee, 'No Mystery About His Muck Method', *FW* LVII/5 (03.08.1962), p. 65.
[243] David Campbell, 'Man of Ag and Fish', *FW* LXXI/24 (12.12.1969), p. 78.

don't like the idea of some of these chemicals on our food,' he admitted. 'I'm d--- [sic] near a natural soil man."[244] However, readers were reassured that Jon's "farm [was] no idealist's retreat:"

> Going intensive so often meant working round the clock to pay off the loan. 'I've heard of people with 100 cows on their hands having to take tranquilisers to keep going. I ask you, what's the point of that?'[245]

While farmers joined 1960s campaigns against supersonic flights, industrial pollution and the destruction of the countryside,[246] they usually reacted hostile to external criticism of agriculture. Even though readers and articles debated pesticides' possible health and environmental hazards, [247] *Farmers Weekly* attempted to downplay potential implications of *Silent Spring* for British agriculture:

> As far as this country is concerned the position is exaggerated but undoubtedly it could be serious (…). The government and the chemical companies are by no means indifferent to the problem and research into new chemicals which will control the pest without killing desirable species is going on. [248]

One year later, Ruth Harrison's *Animal Machines* posed a far greater challenge to British farming. Following the appearance of Harrison's *Observer*-articles in March 1964, *Farmers Weekly* and *British Farmer* were quick to react: according to *British Farmer*, the *Observer* had joined the "anti-land lobby" by publishing "two articles on intensive production which [give] a grossly distorted

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[244] Ibid., p. 79.
[245] Ibid.
[246] 'Cf. 'Stansted Campaign Vindicated', *BF* No. 541 (09.03.1968), p. 12; London's third airport: why destroy good farm land?', *BF* No. 617 (13.09.1969), p. 1; 'Armchair Farming?', *FW* LIII/2 (08.07.1960), p. 43; 'Rubbish fight for Mr Kendall', *FW* LVIII/17 (26.04.2013), p. 59; John Caselee, 'Keeping Britain Tidy', *FW* LVIII/22 (31.05.1963), p. 109; 'Two farmers clear away the rubbish', *FW* LX/10 (06.03.1964), p. 64; 'City Money Coming', *FW* LXXI/25 (19.12.1969), p. 2; Cf. 'Supersonic Flights Condemned by NFU', FW LXI/4, p. 36; 'Ban the Boom', *FW* LXI/9 (28.08.1964), p. 38, Tom Perry, 'Dust Clouds Settle Over Lincs Farms', *FW* LX/7 (14.02.1964), p. 65.
[247] Cf. Major J.C. Mansel, 'Balance of Nature', *BF* No.245 (04.08.1962), pp. 4-5; John D. Daves, 'Balance of Nature', *BF* No.254 (06.10.1962), p. 5; H. Clay, 'Another man's poison', *FW* Vol. LIII No. 5 (29.07.1960), p. 62; 'Danger of insecticides', *FW* LIII/22 (25.11.1960), p. 113; 'Compensation for Dead Bees – and a spray warning system', *FW* LIII/8 (19.08.1960), p. 45; Cf. C.A. York, 'How Safe Is Your Farm?', *FW* LIII/4 (22.07.1960), p. 79; 'Poison on the farms', *FW* LVII No. 21 (23.11.1962), p. 79; 'Agricultural chemicals', *BF* No.257 (27.10.1962), p. 3; 'Agricultural chemicals', *BF* No.337 (25.04.1964), p. 8.
[248] 'Killer Chemicals', *FW* LVIII/15 (12.04.1963), p. 82; another article also assured farmers that better alternatives to DDT were being developed; cf. also 'Lethal Weapons', *FW* LVIII/22 (31.05.1963), p. 98; Montague Keen, 'Chemicals and foam', *BF* No.288 (25.05.1963), p. 4.

picture of British agriculture."[249] The *Observer* was further accused of not printing an NFU counter-statement.[250] In a sharply worded editorial, *Farmers Weekly* bemoaned:

> Townspeople (…) have been given a horrifying picture of the 'animal factories' (…). They are given a chilling picture of broiler house concentration camps and packing station Ausschwitzen [sic], of pig 'sweat-boxes'; of darkened torture-chambers for calves, and of animals going blind in intensive beef lots.[251]

If animals were truly suffering, they would die and not thrive. Harrison's accusation of 'forcing' animals' survival with antibiotics and other drugs was not referred to. Instead, the editor attempted to sunder Harrison's fusion of animal welfare and chemical critique:

> Intensive animal production is under attack on humanitarian grounds which are often charged with more emotion than facts about its supposed evils. The use of certain farm chemicals is being questioned on a different plane – chiefly, on sober scientific findings about their persistency (…) and possible effects on animals and humans.[252]

However, Ruth Harrison and Rachel Carson also struck a nerve among some farmers. Writing to *Farmers Weekly* in 1964, K.M. Ropewind challenged battery farms. Why was an industry suffering from overproduction so intent on sustaining the very technologies producing ever more surpluses?[253] According to Mrs. F. Belsham from Kent, pictures showing intensive methods were "enough to sicken any person with ordinary humane feelings:"[254]

> … it would be a diplomatic move (…) to try and stop some of these cruelties instead of forever dismissing as sentimental rubbish any attempt by anyone to show up to an ignorant public some of the methods by which their 'cheap food' is produced.[255]

In his "Obituary of a calf,"[256] A.H. Harris described the short, sad and incredibly painful life of a male bobby calf to farmers from a first-person perspective.

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[249] 'Feather Heads', *BF* No.333 (28.03.1964), p. 1.
[250] Cf. Ibid.
[251] 'Techniques in Question', *FW* LX/11 (13.03.1964), p. 43.
[252] Ibid.
[253] Cf. K.M. Petter Ropewind, 'Battery Birds', *FW* LX/13 (27.03.1964), p. 41.
[254] F. Belsham, 'Factory Farming', *FW* LX/13 (27.03.1964), p. 42.
[255] Ibid.
[256] A.H. Harris, 'Obituary of a calf', *FW* LXI/3, supplement, (17.07.1964),p. vii.

Once established, a steady trickle of internal criticism continued to challenge the orthodoxy of conventional intensification throughout the 1960s.[257] Trying to profit from *Silent Spring*, Biddle, Sawyer & Co. Ltd. advertised its "Safe, Swift, Sure" insecticide Pyrethrum in *Farmers Weekly*: "It all began with a best-selling book raising the spectre of chemical contamination of our world."[258] Other commercials advertised 'natural' cod liver oil as a substitute for artificial rearing methods.[259]

Meanwhile, proponents of conventional agriculture changed their strategy. Having failed to prevent the Brambell committee with aggressive rhetoric,[260] articles suddenly stressed the necessity of an "informed climate"[261] to discuss intensive agriculture. By the late 1960s, the NFU actively tried to win critics over. Building on its marketing expertise, the NFU produced documentaries titled "Press Button Farms"[262] and "Look to the Land"[263] and organised joint-conferences for farmers and environmentalists.[264] In 1969, *British Farmer* invited "12,000 urban housewives to meet farmer[s]."[265] Following a joint-conference with conservationists, the magazine rejoiced: "Farmers and conservationists are on the same side. (…). They should stop slanging each other and team up against the common enemy – the urban developer."[266] Another article exhorted farmers to "out-conserve the conservators."[267]

In retrospect, the late 1960s were thus an extremely tumultuous period for British farmers. Although some continued to stress the "distinguished

[257] Cf. Colin Tudge, 'Vets Warn of Rising Pollution Hazards', *FW* LXXI/25 (19.12.1969), p. 27; 'Paying for pollution', *FW* LXXI/26 (26.12.1969), p. 18; 'The pesticide dangers that linger in the soil', *FW* LXXI/26 (26.12.1969), p. 22.
[258]'Biddle Sawyer & Co. Commercial', *FW* LVIII/24, supplement, (14.06.1963), p. ii.
[259] Walter Strong, 'What's in the Market', *FW* LXXI/23 (05.12.1969), p. 99.
[260] Cf. 'MPS's move to check factory farms', ibid., p. 47.
[261] 'Informed Climate Needed on Farm Poison Risks', *FW* LX/12 (20.03.1964), p. 64.
[262] 'NFU helped on farming film', *BF* No.501 (10.06.1967), p. 5.
[263] 'The Union makes a film', *BF* No.548 (04.05.1968), p. 22.
[264] Cf. 'Country conservation and the farmer', *BF* No.591 (15.03.1969), p. 9; 'Are Farmers Raping The Countryside', *BF* No.594 (05.04.1969), p. 21; 'Bird Damage Conference', *BF* No.549 (18.05.1968), p. 3; 'Opinion', *BF* No.557 (06.07.1968), p. 9; cf. also 'Opinion', *BF* No.487 (04.03.1967), p. 7; 'Speaking Up For The Union', *BF* No.444 (07.05.1966), p. 10.
[265] '12,000 Urban Housewives To Meet Farmer', *BF* No.620 (04.10.1969), p. 20.
[266] 'The Battle of the Hedgerows', *BF* No.611 (02.08.1969), p. 24.
[267] 'Out-conserve the conservators, says Michael Drake', *BF* No.628 (22.11.1969), p. 6.

service"[268] rendered by wartime agriculture, the war was becoming a remote event for younger generations. The combination of public hostility, internal insecurity and economic pressure produced a seemingly paradox simultaneity of defiant hostility towards critics, melancholic reflexivity and occasional environmental and welfare activism. In contrast to the cohesive modernism of the 1950s, the crumbling promise of universal rural prosperity gave rise to agricultural polyphony.

Controversies about agricultural antibiotics accompanied many of the above-mentioned developments. Initially, farmers maintained an optimistic view of their increasing reliance on antibiotics and even demanded access to restricted substances.[269] However, the 1963 milk scandal produced the first chink in antibiotics' armour. With dairy farmers scrambling to restore trust in their products, the agricultural community endorsed the establishment of official controls and residue-penalties. Only a minority subsequently complained about "iniquitous penalties" and unnecessary "panic measures." [270] Supporting government education campaigns, magazines informed dairy farmers about mastitis prevention and the required post-treatment 48-hour withholding period for milk.[271] In June 1963, an editorial in *Farmers Weekly* commented:

> Dairy farmers have little ground to complain over the row caused by antibiotic content of milk supplies. (…). It is obvious that the principal customers for udder antibiotics, those milk producers with chronic udder troubles in their herds, have been ignoring the quite clear instruction on the use of these drugs.[272]

The magazine also noted that quick antibiotic cures were not going to solve the national mastitis-problem.[273] Concurring, the BVA warned that drugs were "no substitute for hygiene."[274] At the same time, agricultural commentators stressed that antibiotic bans would be counterproductive. According to K.C. Sellers from

[268] 'Put agriculture in the front line says Sir John', *BF* No.599 (10.05.1969), p. 7.
[269] 'Cf. 'Drugs Without Vets' Move By Glos NFU', *FW* LVII/16, (19.10.1962), p. 77; 'Surge on the land.', *FW* LVII/25, p. 41
[270] G.F. Robinson, 'Appalling Penalty', *FW* LXI/3 (17.07.1964), p. 33.
[271] Cf. 'Axe will fall on 'antibiotic' milk', *FW* LVIII/22 (31.05.1963), p. 41; 'MMB sends out warnings on antibiotics', *FW* LVIII/23 (07.06.1963), p. 42; 'Antibiotics Penalties For Approval', *FW* LX/4 (24.01.1964), p. 41; 'Veterinary Safety', *BF* No.328 (22.02.1964), p. 5; K.C. Sellers, 'Mastitis', *BF* No.331 (14.03.1964), pp. 42-45.
[272] 'Tube Trouble', *FW* LVIII/23 (07.06.1963), p. 40.
[273] Cf. 'Dairy Plague', *FW* LVIII/23 (07.06.1963), p. 40.
[274] 'Drugs 'no substitute for hygiene', *FW* LVIII/23 (07.06.1963), p. 42.

the Animal Health Trust, preventive measures had to become more effective before antibiotic bans could be considered.[275] By blaming antibiotic overuse on black sheep and embracing controls, the agricultural community successfully deflected larger damage.[276]

While most commentators went back to presenting antibiotics as unproblematic helpers,[277] others began challenging antibiotic-complacency following the publication of *Animal Machines*: in 1964, veterinary investigation officer R.M. Loosmore told farmers that "indiscriminate use of pig foods containing antibiotics can mask the causes of scouring."[278] To make matters worse, antibiotic-use was causing problems for meat inspectors: "If we get carcasses sodden with antibiotics we don't stand much chance of finding anything."[279] Faced with continuing cases of antibiotic residues in milk, agricultural commentators condemned "this selfish and careless practice."[280] In 1965, *British Farmer* printed a long article by veterinarian James Wentworth Day.[281] Appearing over a year after initial reports on 'infectious resistance', Day described the dangers of horizontal resistance transfer:

> Too many doctors and farmers are dosing human beings, pigs, calves and poultry with antibiotics for minor illnesses or as animal food additives. (…). This can mean that human beings and livestock are less easily treated for more serious epidemics, including typhoid in human beings. In short, the use of antibiotics has been overdone.[282]

According to Day, there was an "urgent need for reappraisal of the use of antibiotics both in human beings and animals."[283]

However, such outright criticism remained an exception. Between 1965 and 1967, *British Farmer's* only other reference to resistance problems was a

[275] Cf. 'Antibiotics In Milk', *BF* No. 331 (14.03.1964), p. 45.
[276] Glaxo attempted to profit from the situation by marketing 'approved' products for the duration of the scandal; cf. 'Glaxo Commercial Cerates', *FW* LVIII/23 (07.06.1963), p. 54.
[277] Cf. C.C. Wannop, 'Three Disease Threats To The Growing Bird', *FW* LX/8 (21.02.1964), p. 109; the ministry of agriculture aided this perception by announcing a voluntary scheme of veterinary medicines approval, which could then be purchased by farmers; cf. 'Approval Scheme for Vet's Chemicals', *FW* LX/8 (21.02.1964), p. 51.
[278] 'Misused drugs mask disease', *FW* LX/10 (06.03.1964), p. 71.
[279] Ibid.
[280] 'Milk clean-up', *FW* LXI/8 (21.08.1964), p. 39; cf. also Ernest Jay, ''Drugs in Milk' warning', *FW* LXI/8 (21.08.1964), p. 43.
[281] James Wentworth Day, 'Misuse of Antibiotics', *BF* No.453 (09.07.1966), p. 3.
[282] Ibid.
[283] Ibid.

report on a new growth promoter: containing nontherapeutic virginiamycin, 'Eskalin' was praised for answering "criticisms that continuous low level feeding of an antibiotic (…) can induce bacterial resistance."[284] At the same time, the magazine happily continued to print antibiotic commercials:[285] in 1965, Cyanamid advertised the prophylactic use of Aurofac prior to animal transports. Titled "Have Aureomycin – Will Travel,"[286] commercials depicted calves and pigs in front of small travelling crates and praised reductions of transport-induced scouring and mortality.[287] Linking antibiotic-criticism to the "anti-factory farming lobby", which "always appears to get the headlines,"[288] *Farmers Weekly* complained about claims "that antibiotics such as chloramphenicol are included in the feed of laying birds as a matter of routine."[289] In October 1969, an editorial satirically summarised farmers' self-perceived public image:

> You, dear reader, are a pretty nasty customer if the hysterical gibbering of the anti 'factory farming' lobby has any substance. (…). You keep your stock in pens and cages in which they cannot move or groom themselves; you are so greedy for the quick profit that you totally disregard the lives or welfare of your animals; you are a ruthless and unscrupulous exploiter of dumb creatures; your pigs and calves have become the 'prisoners' of human greed.' You are a bit of a fiend, in fact.[290]

As a consequence, many farmers hoped that the Swann committee would provide clear guidelines and dissolve public and personal doubts about agricultural antibiotics' safety. By October 1969, growing apprehension about possible Swann bans became noticeable in the agricultural media. Informing farmers about the advantages of numerous growth promoters, *Farmers Weekly* cautioned that "confident guesses rule out many antibiotics now used"[291] – however, "there are drugs available as replacements."[292] Titled "Drugs and

[284] 'Growth only from this antibiotic', *BF* No.492 (08.04.1967), p. 47.
[285] Cf. 'Commercial Pfizer – Terramycin', *BF* No.383 (13.03.1965), p. 28; 'Commercial Cyanamid – Aureomycin', *BF* No.405 (07.08.1965), p. 37.
[286] 'Commercial Cyanamid – Aureomycin', *BF* No.422 (04.12.1965), p. 46.; 'Commercial Cyanamid – Aureomycin', *BF* No.409 (04.09.1965), p. 39.
[287] Cf. Ibid.
[288] 'Sentiments and Facts', *FW* LXXI/21 (21.11.1969), p. 82.
[289] Ibid.
[290] 'You monster!', *FW* LXXXI/17 (24.10.1969), p. 34.
[291] 'Putting on weight', *FW* LXXI/14, supplement, (03.10.1969), p. 27.
[292] Ibid.

Bugs," [293] another article analysed antibiotic resistance in more detail: if preventing the spread of resistant farm bacteria to consumers was the main worry, then resistance transmission via meat and eggs and not resistance creation was the problem. In other words, better farm hygiene and cleaner packing stations would be more effective than bans.[294]

In contrast to farmers, veterinarians were more outspoken in their support of antibiotic bans. Asked to provide recommendations to the Swann committee, the Veterinarians' Union (VETU) called for a ban of all antibiotic feed supplements.[295] By contrast, the BVA only supported a ban of chloramphenicol, tylosin and broad-spectrum antibiotics in feeds.[296] In his 1969 farewell address, out-going BVA president Peter Storie-Pugh looked forward to a time "when his profession could offer farmers an advisory service which could cost far less than a shelffull of drugs."[297] At the 1969 BVA congress, another paper attacked "kit[s] of antibiotics and other medicines" [298] accompanying deliveries of contract-rearing calves. However, veterinarians' criticism was far from self-reflexive. Concerned about a loss of veterinary status, the BVA warned that restrictions of veterinary antibiotic use "should be paralleled by a like restriction on medical practice."[299] In 1969, the new BVA president John Parsons excluded prescription practices from his demand for more state control.[300]

By early November 1969, speculations about Swann were substituted by extremely precise "inspired 'leaks." [301] Complaining about "alarmist" press coverage, *Farmers Weekly* explained that the "talk of a 'new peril in food' is an exaggeration of the scientific problems presented by the increased use of these generally beneficial substances, …"[302] Cautioning farmers to trust the Swann committee's expertise, the editorial commiserated intensive farmers, who felt "harassed a bit too much" about methods "which have not yet been proved to be

[293] 'Drugs and Bugs', *FW* LXXI/15, p. 110.
[294] Cf. Ibid.
[295] Cf. Ibid.
[296] TNA AJ 3/183 (Cecil Schwartz, 'Vets advise Swann', *New Scientist*, 13.02.1969), pp. 348-349.
[297] 'Drugs: Good Servants, Bad Masters', *BF* No.620 (04.10.1969), p. 45.
[298] Ibid.
[299] Ibid., p. 349.
[300] Cf. Ibid.
[301] 'Clamp on antibiotics', *FW* LXXI/20 (14.11.1969), p. 30; cf. also; 'Charter For Antibiotics Proposed', *FW* LXXI/20 (14.11.1969), p. 33.
[302] Ibid.

seriously at fault."[303] Concurring, *British Farmer* claimed that potential antibiotic bans were based on "little convincing evidence"[304] and might cost farmers up to £10 million. Referring to the Manchester and Teesside outbreaks, another article reaffirmed that there was no evidence linking resistant gastroenteritis to farms.[305] Indeed, farmers hoped that lack of proof would lead officials "to impose a reasonable measure of control rather than to stop the practice altogether."[306] Referring to the recent watering-down of the Brambell recommendations, *Farmers Weekly* hoped that "decisions [would] be based on science, not on sentiment."[307]

Even though they complained about "purely circumstantial evidence" and lack of "real facts"[308], farmers remained convinced of the Swann experts' trustworthiness. Integrated into official decision-making since the Second World War, British farmers had developed a thorough knowledge of *and* trust in the corporatist system they had helped design.[309] Even though the Swann decisions would influence the pending regulation of pesticides like DDT,[310] farmers and their representatives knew that agricultural expertise would be present and heard in official committees. From experience, they also knew that compromise solutions were far more likely to occur in discrete committees than during polarizing public hearings or debates. Shielded from public scrutiny, friendly experts could modify scenarios of risk and risk management without risking

[303] Ibid.
[304] 'Likely Curb on Feed Drugs Worth £10 m', *BF* No.624 (01.11.1969), p. 18.
[305] 'What proof?', *FW* LXXI/20 (14.11.1969), p. 30.
[306] Ibid.
[307] 'What proof?', *FW* LXXI/20 (14.11.1969), p. 30.
[308] 'Little evidence', *FW* LXXI/23 (05.12.1969), p. 77.
[309] British farmers' integration into official committees mirrored similar connections between the British government and pharmaceutical companies. Whereas European traditions of corporatism shielded individuals from public scrutiny, American political culture relied on experts' public presentation of evidence – thus making the strength of evidence dependent on experts' 'moral' authority. As a consequence, public *ad hominem* attacks on opponents to discredit their expertise and 'facts' became a mainstay of American risk debates. Exposed to the public eye, American 'political entrepreneurs' tended to favour maximum control scenarios so as not to seem irresponsible. In Europe, committees rarely acknowledged internal disagreements and favoured compromise arrangements while obscuring political responsibility; cf. Georg Krücken, *Risikotransformation. Die Politische Regulierung Technisch-Ökologischer Gefahren in Der Risikogesellschaft* (Opladen/ Wiesbaden: Westdeutscher Verlag, 1997), pp. 94 & 99-109.; cf. Sheila Jasanoff, *Designs on Nature: Science and Democracy in Europe & the United States.* (2 edn.; Princeton and Oxford: Princeton University Press, 2007), pp. 288-89, Sheila Jasanoff, *The Fifth Branch. Science Advisers as Policymakers* (Cambridge (Ma.) and London: Harvard University Press, 1994).
[310] Cf. Peter Bell, 'The Month', *BF* No.629 (06.12.1969), p. 12.

their prestige. Once publicly announced, a committee's findings would then profit from experts' united 'trustworthiness' and reduce the likelihood of further controversy.[311]

As a consequence, farmers were relieved to find little radicalism in the Swann report following its publication in November 1969.[312] Even though it lobbied for financial compensation, *Farmers Weekly* admitted: "no sensible farmer would wish to [continue] using a drug which (…) could be a later risk to public health." [313] One week later, the magazine published a strong warning concerning antibiotic resistance:[314]

> By mass use of low-dose antibiotics in farm animals we are creating a reservoir of drug-resistant bacteria. (…). Already some people have died through infection with salmonellae acquired from animals that resisted all attempts at drug therapy. (…). The range of useful antibiotics is limited: we cannot afford to devalue them.[315]

In December 1969, *British Farmer* followed suit: "On the evidence, the Minister's decision was a reasonable one and will be accepted by farmers as reasonable, …"[316]

Indeed, British farmers were only grazed by the Swann bans.[317] As announced by the agricultural press, substitute growth promoters were either ready for use or in the final stages of licensing.[318] At the same time, the government assured farmers that penicillin and tetracycline growth promoters would not be banned over night but phased out gradually.[319] Jokingly, *British Farmer* summed up the situation:

> There will be no more drug kits for calves sent for veal rearing under contract and a clamp-down on the distribution of cheap, on-the-side

[311] This dissertation's model of a confined, discrete and epistemologically fluid space in which risk models and control strategies compete with each other, are selected and finally communicated to a broader external public is based on Ludwik Fleck's conception of science, which was subsequently adopted by Bruno Latour's Actor-Network-Theory (cf. nodal computation centres in networks); cf. Ludwik Fleck, *Genesis and Development of a Scientific Fact* (Chicago and London: University of Chicago Press, 1979), p. 124, Bruno Latour, *Science in Action* (Cambridge (Ma.): Harvard University Press, 1987), pp. 220-57.
[312] Cf. 'Blow to Antibiotics In Feed', *BF* No.627 (22.11.1969), p. 3.
[313] 'Drug Worry', *FW* LXXI/21 (21.11.1969), p. 33.
[314] Cf. Collin Tudge, 'Antibiotics – Farm Drugs With A Double Edge', *FW* LXXI/21 (21.11.1969), pp. 40-41.
[315] Ibid., p. 41.
[316] 'Opinion. Swann Song', *BF* No.629 (06.12.1969), p. 11.
[317] Cf. 'Watchdog plan for farm drugs', *FW* LXXI/21 (21.11.1969), p. 38.
[318] Cf. 'Same price for additives', *FW* LXII/22 (28.11.1969), p. 40.
[319] Cf. Brian Chester, 'Drug Changes Will Be Made In Easy Stages', *FW* LXII/22 (28.11.1969), p. 40.

> antibiotics coming in from abroad. It is to be presumed that the rows of bottles on some farm office shelves will be seriously depleted![320]

While the NFU called for veiled protectionism in the form of imports' antibiotic resistance monitoring,[321] the Chairman of the British Poultry Federation welcomed the opportunity to market British poultry as "the best and safest in the world."[322] Reacting to Swann, R.J.T. Holland suggested "turning the situation to [farmers'] advantage by such a slogan as 'British food is safe food'."[323] Welcoming the bans, a small Sussex farmer claimed that he had never used antibiotics in spite of having been "pestered by various salesmen":

> I am quite happy with my 'anti-antibiotic' profit, (…) safe in the knowledge that if things go wrong there are no resistant bugs to deal with.[324]

However, for G. Armstrong, the real Swann-profiteers were British veterinarians: "My vet seems more pleased to sell products himself. I feel it is not in farmers' best interests for a 'closed shop' to develop."[325]

[320] Peter Bell, 'Never A Dull Moment, With Drugs And Sheep And Crippling Tax', *BF* No.628 (29.11.1969), p. 1.
[321] Ibid.; cf. also 'The Swann Report On Antibiotics', *BF* No.629 (06.12.1969), p. 15.
[322] Brian Chester, 'Drug Changes Will Be Made In Easy Stages', *FW* LXII/22 (28.11.1969), p. 40; cf. also the progressive image conveyed by *British Farmer*; cf. Peter Bell, 'The Month', *BF* No.629 (06.12.1969), p. 12.
[323] R.J.T. Holland, ''Safe food' promotion', *FW* LXXI/23 (05.12.1969), p. 49.
[324] Bill Message, 'Antibiotic safety', *FW* LXXII/4 (23.01.1970), p. 31.
[325] G. Armstrong, ''Closed shop' drugs', *FW* LXXI/23 (05.12.1969), p. 49.

The State

For the British state, the Swann recommendations promised to amicably solve the conflict between agricultural interests and public health considerations. Within official circles, antibiotic feeds had been controversial even before they were legalised. In 1951, the UK had embarked on a series of feed experiments on various government farms.[326] While US publications and positive trial results bolstered support for antibiotic growth promotion,[327] some bureaucrats were apprehensive regarding the patchy state of scientific knowledge: "The difficulty seems to be that no one apparently knows what the antibiotics does [sic] and how it acts."[328] In July 1953, Thomas – Tom – Dugdale, Labour's Minister for Agriculture, confided to NFU president Sir James Turner that he considered the mass-introduction of antibiotics as a medical experiment of national dimensions:

> Our knowledge of antibiotics in feedingstuffs is still comparatively in infancy, but the regulations we are proposing to make will, by permitting antibiotics to be used generally for the first time, enable all of us (…) to increase our practical experience. Subsequently, it may become possible, in the light of that experience to make new regulations.[329]

In contrast to Dugdale's sanguine views, Ministry of Health (MH) officials repeatedly warned against the rise of antibiotic allergies and antibiotic resistant pathogens: "the whole purpose of the Penicillin Act was to prevent penicillin and other antibiotics being used indiscriminately with a consequent danger of producing penicillin resistant strains of pathogens."[330] In this context, critics were particularly hostile towards plans to allow farmers to purchase both supplemented feeds and diluted antibiotic substrates for home-mixing.[331]

However, critics' concerns had little force. During relevant ministerial meetings, medical experts repeatedly asserted that any "risk to health was negligible."[332] At the same time, agricultural officials played on government concerns about national currency and trade problems when they projected an

[326] Cf. TNA FD 9/1458 (E. M. B. Clements to Prof. A. A. Miles, 28 Mar, 1960), p.1.
[327] Cf. The National Archives of the UK [in the following: TNA], MAF 119/23 (Agricultural Research Council (ARC), Meeting 19 September, 1952), p. 1.
[328] TNA, MAF 119/23 (Minute Hill to Croxford, 19 April, 1952).
[329] TNA, MAF 287/299 (Dugdale to Turner, 29 July, 1953), p. 2.
[330] Cf. TNA, MAF 119/23 (Mr. Honnor, ARC, meeting 19 September, 1952), p. 3.
[331] Cf. Ibid.
[332] TNA MAF 119/23 (Dr. Magee; ARC, meeting, 25 February, 1952), p. 2.

"immediate increase in agricultural production accompanied possibly by a saving in the consumption of [imported] feeding stuffs."[333] Downplaying possible resistance development, the animal nutritionist Dr. Braude referred to the increasing number of new antibiotics, which were readily available for use against resistant pathogens.[334] Even though they were offended by their late consultation, the British Veterinary Association (BVA) and the Royal College of Veterinary Surgeons (RCVS) did not oppose the legalisation of antibiotic feeds either.[335]

Indeed, ahead of legalising antibiotic feeds, officials' main fear was being unable to supply the projected demand. As a consequence, the British government approached American pharmaceutical companies in order to ensure sufficient stocks of antibiotics other than penicillin. Pouncing on the opportunity to extend sales of its chlortetracycline based AUROFAC2A, American Cyanamid's Lederle Laboratories Division offered free Aureomycin Magnasol Cake and the expertise of its feed scientist Thomas Jukes. Concluding his letter, O. N. Williams, Lederle Laboratories' director, hoped that this would "be the beginning of an association which will be of mutual benefit."[336]

As has been shown, the TSA's legalisation of ready-mixed penicillin and aureomycin feeds and self-mix supplements for pigs and poultry laid an important foundation for the intensification of British livestock husbandry. However, many of the Act's provisions came back to haunt Whitehall officials. Already identified as a problem by contemporaries, Britain lacked analytical facilities capable of detecting the presence and concentration of antibiotics in animals and food on a large scale.[337] For data on residues, British officials relied heavily on academic publications and foreign enforcement agencies – most notably the American Food and Drugs Authority (FDA). At the same time, the TSA's enforcement remained confined to the retail level where it was carried out by officers of the Pharmaceutical Society. Beyond the retail level, authorities had

[333] TNA MAF 119/23 (W. G. Alexander; ARC, meeting, 25 February, 1952), p. 2.
[334] Cf. TNA MAF 287/299 (Dr. R. Braude; Meeting at Saughton to discuss TSA draft regulations, 4th February, 1953), p. 3.
[335] Cf. TNA MAF 287/299 (Veterinary Interests, Meeting RCVS and BVA with MH and MAF, 12 February, 1953).
[336] TNA, MAF 287/299 (Williams to Moss, 5th February 1953), p. 2.
[337] Cf. TNA MAF 119/23 (Sgd. A. Eden to O. A. Robertson, 2 Nov, 1953), p. 2.

no powers to prohibit farmers from using legally purchased antibiotics and antibiotic substrates as they pleased. Obviously, the same was true for veterinarians' prescription practices.[338] In hindsight, the 1953 TSA thus opened the flood-gates for a public health experiment of national proportions. However, the authorities tasked with protecting the British public were neither able to detect harmful consequences nor punish offenders. They were flying blind.

Attempting to regulate antibiotics comprehensively, the 1956 TSA did not bring many improvements. While Part I of the TSA dealt with the licensing, manufacturing and importation of medications to ensure their purity, Part II of the Act scheduled substances that were to be sold on prescription only – amongst them penicillin and the tetracyclines. Once again, the 1956 TSA made special provisions for the relaxation of controls in the case of animal feeds with low antibiotic doses.[339] More worryingly, the absence of mandatory restrictive scheduling of new substances meant that recently discovered antibiotics could theoretically be sold and used without any control. Considered therapeutically irrelevant by contemporaries, the antibiotic Tylosin fell into this category.[340] Once again, officials and manufacturers remained surprisingly sanguine: as Glaxo's ex-chief executive scientific officer Alfred Louis Bacharach put it, a "gentleman's agreement"[341] between manufacturers and the MAFF was sure to prevent any misuse. Until 1968, an aptly named voluntary Veterinary Products Safety Precautions Scheme merely suggested guidelines for unscheduled substances.[342]

While antibiotic enforcement thus withered, expert committees bloomed: because antibiotics' numerous applications transcended traditional responsibilities, a veritable jungle of committees became concerned with their use. Originally, the independent Medical and Agricultural Research Councils (MRC and ARC) had been responsible for advising ministers on agricultural antibiotics. However, by 1956, further committees with complicated names had

[338] Cf. TNA MAF 287/299 (Meeting at Saughton to discuss TSA draft regulations, 4 February 1953), p. 1.
[339] Cf. TNA MAF 119/23 (Draft: F. G. Raymond to G. L. Gray, 26 Nov, 1968).
[340] Cf. TNA MAF 284/281 (Minute 27, A. B. Bartlett, 10 Apr, 1956).
[341] Bacharach, A.L., 'UK Position on Use of Antibiotic Food Additives', *Chemical Age*, 78 (1957), p. 176.
[342] Cf. TNA MAF 284/281 (Control of Antibiotics, Feb, 1969), p. 1.

become involved. Amongst them were the Preservatives Sub-Committee of the Food Standards Committee and the Scientific Sub-Committee of the Advisory Committee on Poisonous Substances Used in Agriculture and Food Storage, who in turn combined their resources to found a joint Antibiotics Panel.[343] Confusion was bound to result. Exchanging minutes in the mid-1960s, one official noted: "I have been quite unable to understand the relationship between these bodies."[344] Sharing his colleague's exasperation, another official admitted: "The situation is now so complicated that it is almost un-understandable."[345]

In the meantime, the list of permitted agricultural antibiotics and their uses grew rapidly. In 1954, the Therapeutic Substances (Supply of Oxytetracycline for Agricultural Purposes) Regulations legalised the use of oxytetracycline in feeds. Combatting bacterial infections of crops and fruit trees, streptomycin and oxytetracycline sprays and paints were permitted four years later.[346] During their trial phase, the MRC's Brandon Lush was concerned that antibiotic residues might alter the human gut flora and produce resistant pathogens. However, official equanimity prevailed: in the case of Lush's fears, the absence of a bacteriologist on the Scientific Subcommittee on Poisonous Substances Used in Agriculture prevented any further deliberation.[347] Meanwhile, prominent scientists like Howard Florey declared horticultural uses of antibiotics harmless.[348] In 1956, Glaxo was allowed to sell 30 tons of streptomycin-sprayed test cherries to consumers before the spray had cleared official licensing.[349]

Regarding possible dangers to farm workers, the recently instituted Antibiotics Panel debated whether workers' tougher skin would make them less sensitive to antibiotic allergies than nurses.[350] Ultimately, MAFF's proposed

[343] Cf. TNA MAF 101/643 (Note of Meeting held on 13.09.1956, to discuss the setting up of a Working Group on the use of Antibiotics in Agriculture and in Food Preservation).
[344] TNA MAF 287/450 (Minute, J. Hensley to Mr. Bott, 9 Jan, 1967).
[345] TNA MAF 287/450 (Minute, W.D. Macrae to Mr. Field, 18 Jan, 1967), p. 2.
[346] Cf. MAF 284/282 (Control of Antibiotics, Appendix III: List of relaxing regulations made under Part II of the therapeutic Substances Act 1956, Feb, 1959)
[347] TNA MAF 284/281 (Brandon Lush to G. O. Lace, 4 Jul, 1956).
[348] TNA MAF 284/281 (Minute 30, G. O. Lush, 30 May, 1956).
[349] Cf. TNA MAF 260/82 (Scientific Subcommittee on Poisonous Substances Used in Agriculture and Food, 26 Nov, 1956), p. 2.
[350] TNA MAF 260/82 (Antibiotics Panel, Meeting, 20 Dec, 1956), p. 2; health workers' antibiotic allergies had received serious attention since 1953; cf. TNA PIN 20/216 (Sensitisation of Nursing Staffs to Antibiotics, Extract from *The Lancet*, 4 Jul, 1953), pp. 1-3.

labels for antibiotic sprays and paints only recommended washing contaminated skin. Astonished by this complacency, Murphy's, the manufacturer applying for the spray's legalisation, rejected MAFF's labels and recommended full-body cover and face-shields for workers.[351]

Meanwhile, American pharmaceutical companies wanted to use antibiotics to preserve British food.[352] Mirroring American legislation, fresh caught fish was to be preserved with tetracycline ice on trawlers. Thinking creatively, manufacturers also developed explosive whale harpoons containing 25 grams of tetracycline to guarantee 'clean' wounds. On land, eviscerated fowl were to be preserved by two-hour suspension in an iced solution containing 10-20ppm tetracycline.[353] Unsurprisingly, Lederle generously sponsored British aureomycin preservative trials aboard the government trawler Sir William Hardy.[354] In an already familiar manner, officials initially treated concerns about resistance and antibiotic residues in and on carcasses as harmless.[355] While the absence of spoilage-indicating bacteria, resistance build-up in dipping tanks and lacking enforcement rights prevented antibiotic poultry preservation, the same caveats were not applied to fish for which antibiotic ice and dipping solutions, were legalised in 1964.[356]

Retrospectively, Britain's 1950s happy-go-lucky attitude regarding agricultural antibiotics seems bizarre. However, Britain's apparent recklessness can be explained by four factors: the first and decisive factor was that experts still considered antibiotic resistance to result from isolated mutations within individual bacteria. The second factor behind official complacency was Britain's lack of analytical facilities. Unwilling to finance expensive testing programmes, the extent of antibiotic residue and resistance problems remained invisible. As a result, enforcement of well-meant safety guidelines proved impossible. The third factor was the extremely close relationship between officials, experts and

[351] Cf. TNA MAF 284/281 (E. J. Miller to R. S. Mills, 18 Mar, 1958).
[352] CF. TNA MAF 101/643 (Department of Scientific and Industrial Research. Food Investigation. Preliminary report of the visit of Dr. Ella M. Barnes to the USA to investigate the use of antibiotics for food preservation, 1956), p. 1.
[353] Cf. TNA MAF 260/82 (Reports of the Antibiotic Panel, 09 Apr, 1958), p. 1.
[354] Cf. TNA MAF 101/643 (Note: Antibiotics for Fish Preservation. Pilot Scale Sea Trials, undated)
[355] Cf. Ibid., pp. 5-6.
[356] Cf. Cf. MAF 284/282 (Control of Antibiotics, Appendix III: List of relaxing regulations made under Part II of the therapeutic Substances Act 1956, Feb, 1959)

industry and a history of *laissez-faire* consumer protection.[357] Once made, gentlemen's agreements were hard to break. The fourth factor was a certain national pride of having established a cheaper and faster alternative to the supposedly cumbersome US system. In a 1956 to the Western European Union Sub-Committee on Health Control of Foodstuffs, the UK delegation made its position very explicit:

> The United Kingdom feels that the problem of consumer hazard can be tackled in more than one way. (…). The successful application of the American system is dependent upon the existence of the necessary governmental machinery. (…). The United Kingdom delegation feels that cost and scientific management problems make it impossible for them to advocate a system of control of residues on prescribed tolerances.[358]

By the second half of the 1950s, overall risk perceptions regarding agricultural antibiotics were changing. Discussing US reports on antibiotic residues in milk during its first meeting in 1956, the Antibiotics Panel bemoaned lacking British residue data.[359] However, members tried to take a positive view:

> In view of the enormous amount of uncooked milk consumed daily by the American population and the propensity of penicillin to produce allergic reactions, it would appear that they have here a large scale experiment already completed …[360]

With only one proven non-fatal reaction to penicillin, MAFF officials argued that the American findings actually justified antibiotic food preservation.[361]

Regarding resistance, it was increasingly difficult to remain complacent. In 1959, an article in *The Veterinary Record* presented uncomfortable findings. In their study, H. Williams Smith and W.E. Crab compared nasal and skin isolates of 160 tetracycline-fed pigs to those taken from an identical control group fed without antibiotics. While 72% of pigs in the tetracycline-group carried

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[357] Mike French and Jim Philips have shown that relationships between the food and chemical industry and government officials had already been very friendly during the interwar years; cf. Mike French and Jim Phillips, 'Compositional Food Standards in the United Kingdom: The Case of the Willis Inquiry, 1929-1934', in David F. Smith and Jim Philips (eds.), *Food, Science, Policy and Regulation in the Twentieth Century. International and Comparative Perspectives* (London and New York: Routledge, 2000), p. 32.
[358] TNA MAF 260/82 (Western European Union Sub-Committee on Health Control of Foodstuffs. Working Party on Poisonous Substances Used in Agriculture; Draft Paper by UK Delegation, 1956), pp. 6-7; cf. also TNA MAF 260/82 (Scientific Subcommittee on Poisonous Substances Used in Agriculture and Food, 26 Nov, 1956), p. 2.
[359] Cf. TNA MAF 260/82 (Antibiotics Panel, Meeting, 20 Dec, 1956), p. 1.
[360] TNA MAF 101/643 (H.H. Taylor to Dr. W.T.C. Berry, 9 Oct, 1957), p. 4.
[361] Cf. Ibid.

Staphylococcus aureus, an impressive 67% carried *Staph. aureus* resistant to tetracyclines. Interested in the spread of resistance, Williams Smith and Crab also examined the pigs' human attendants: of 35 men caring for tetracycline-fed pigs, 54% carried strains of *Staph. aureus*, 11% strains resistant to penicillin and 34% strains resistant to tetracyclines. Having analysed 50 additional attendants caring for tetracycline- and penicillin-fed chickens, the authors found that 48% of attendants carried *Staph. aureus*, 30% penicillin-resistant *Staph. aureus*, 14% tetracycline-resistant *Staph. aureus* and 4% penicillin- and tetracycline-resistant *Staph. aureus*. In most cases, the isolated strains from attendants and animals were identical. [362] Speaking at an ARC conference, Dr R.F. Gordon from the Houghton Poultry Research Station warned that poultry farmers were raising feeds' antibiotic content to therapeutic levels. While diseases were not being determined prior to administering antibiotics, residues in carcasses prevented post-mortem bacteriological analysis.[363]

In the wake of these revelations, a team of government scientists under the direction of E.S. Anderson found that strains of *Salmonella typhimurium* isolated from British poultry were resistant to antibiotics used in chicken feeds. Significantly, *Salmonella typhimurium* was a close relative of the typhoid-causing *Salmonella typhi*. Referring to the study before its official publication,[364] the ARC demanded a general reassessment of antibiotic feeds' safety.[365] The review was to be undertaken ahead of potential extensions of feeds to calves and layer hens.[366] Taken aback by the ARC's request, the MRC marvelled: "In fact they are

[362] Reprint in TNA MAF 260/82 (H. Williams Smith and W.E. Crab, 'The Effect of the Continuous Administration of Diets Containing Low Levels of Tetracyclines on the Incidence of Drug-resistant Bacterium coli in the Faeces of Pigs and Chickens: The Sensitivity of the Bact. coli to Other Chemotherapeutic Agents, *The Veterinary Record* 69 (1959)), p. 24; a good summary can be found in: 'Drug-Resistant Staphylococci In The Farmyard', *The Lancet*, 275/7138 (June 1960), pp. 1338-1339; in the same year, J. C. Gould from the University of Edinburgh identified environmental penicillin in factories and hospitals as a significant contributor to resistant *Staphylococcus pyogenes; cf.* J. C. Gould, 'Origin of Antibiotic-Resistant Staphylococci', *Nature,* 180/4580 (Aug 10 1957).
[363] Cf. TNA MAF 189/911 (Some Problems Associated With The Use of Antibiotics in Poultry Husbandry in Great Britain, R.F. Gordon, ARC 146/58). p. 5.
[364] B. C. Hobbs et al., 'Antibiotic Treatment of Poultry in Relation to Salmonella Typhi-Murium', *Mon Bull Minist Health Public Health Lab Serv,* 19 (Oct 1960).; Anderson appears as Principal Investigator.
[365] Cf. FD 9/1458 (L. S. Porter to Dr. Clements, 17 Jul, 1959)
[366] Cf. Ibid.

seriously considering withdrawing approval of the adding of antibiotics; in other words, they are considering putting the clock back."[367]

Diverging from American-German preoccupations with antibiotic residues, Britain's seemingly unique focus on antibiotic resistance was no coincidence. Instead, it can be explained by the country's emerging leadership in resistance research and phage-typing. Expanding rapidly during the 1940s, 'phage-typing' was a technique used to identify individual strains of bacteria with the help of bacteria-infecting viruses called bacteriophages. Because each bacteria strain is only susceptible to a limited amount of phages, infecting bacteria and 'typing' subsequent phage-infection patterns is an efficient way of discerning individual strains.[368]

Developed by James Craigie and a colleague in Canada, phage-typing was adopted in Britain by Arthur Felix.[369] Born in Silesia as the son of a dye manufacturer in 1887, Felix studied chemistry in Vienna, where he befriended Chaim Weitzman and became a passionate Zionist. Following the outbreak of the First World War, Felix worked for the No. 5 Austrian Mobile Epidemiological Laboratory and devised an antigen test for typhus fever together with his superior, the German bacteriologist Edmund Weil. After the war, Felix moved to Palestine, where he was appointed Director of the Bacteriological Laboratory of the Hadassah Medical Organization in Tel Aviv in 1921 and Chief Bacteriologist of the Jerusalem Laboratory in 1922. Following Weil's death in 1922, Felix continued his work on the identification of pathogens via blood antigens. After a visit to London's Lister Institute of Preventive Medicine in 1927, Felix resigned his post and moved to England. Seven years later, he demonstrated that virulent strains of the typhoid bacillus *S. typhi* possess an antigen, which he named V (for virulence) antigen.[370] Working on the development of a V-antigen test for typhoid, Felix became interested in phage-typing and the outbreak of the Second World War helped him to refine the technique.

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[367] TNA FD 9/1458 (Note on file, A.83/4, 9 Sept, 1959).
[368] Cf. Kathryn Hillier, 'Babies and Bacteria: Phage Typing Bacteriologists, and the Birth of Infection Control', *Bulletin of the History of Medicine,* 80/4 (2006), p. 735.
[369] Cf. Smith et al., *Food Poisoning, Policy and Politics. Corned Beef and Typhoid in Britain in the 1960s*, pp. 15-20.
[370] Cf. J. Craigie, 'Arthur Felix 1887-1956', *Biographical Memoirs of Fellows of the Royal Society,* 3 (1957), pp. 53-56.

As an experienced bacteriologist, Felix was enrolled in the Emergency Medical Service (EMS) in 1938 and seconded to the Emergency Public Health Laboratory Service (EPHLS).[371] Established in preparation for war, EMS was tasked with developing a bacteriological infrastructure to prevent disease outbreaks resulting from the bombed water systems. Although no major epidemics occurred, the foundation of the EMS resulted in the establishment of a centralised network of public health laboratories with sophisticated bacteriological equipment.[372] In London, Felix used the V-test and phage-typing to establish a "finger-print bureau"[373] for chronic carriers of typhoid and trace sources of sporadic outbreaks. Due to its complexity, phage-typing facilitated an unprecedented centralisation of British bacteriological monitoring.

Following the transformation of the EPHLS into the Public Health Laboratory Service (PHLS) in 1945, Felix stayed on as Director of the Central Enteric Reference Laboratory in Colindale. In 1947, he published a standardized method for phage-typing together with Craigie.[374] Steadily building a 'library' of phages, Colindale's function as a hub was acknowledged by the Fourth International Congress for Microbiology in Copenhagen, which appointed Colindale as International Reference Laboratory for enteric phage typing.[375] By the time Felix' successor – the already familiar E. S. Anderson – took over in 1953, the PHLS was a global leader in phage-typing and monitoring rising numbers of British *Salmonella* outbreaks.

Able to trace individual strains, PHLS researchers were ideally based to recognize the threats posed by antibiotic-resistance. In 1954, British phage-typing expertise was crucial in revealing the "chains of infection"[376] behind the first identified pandemic of resistant bacteria. Similar to the Enteric Reference Laboratory, Colindale's Staphylococcal Reference Laboratory had only recently been appointed international phage reference centre in 1953.[377] One year later, a

[371] Cf. Ibid., pp. 55-56.
[372] Cf. Smith et al., *Food Poisoning, Policy and Politics. Corned Beef and Typhoid in Britain in the 1960s*, pp. 16-17.
[373] Ibid., p. 17.
[374] Cf. Ibid., p. 18.
[375] Cf. Ibid., pp. 18-20.
[376] Hillier, 'Babies and Bacteria: Phage Typing Bacteriologists, and the Birth of Infection Control', p. 736.
[377] Cf. Ibid., p. 739.

strain of resistant *Staphylococcus* 80/81 isolated from an Australian maternity ward was sent to Colindale for identification. Soon afterwards, samples reaching Colindale from Canadian, British and American wards also turned out to be *Staph* 80/81.[378] In maternity wards, *Staph* 80/81 caused pustular skin lesions with surrounding cellulitis in babies, breast abscesses in mothers and babies and severe boils in nurses.[379] Attempting to combat *Staph* 80/81, hospital bacteriologists used the provided phage-typing expertise to remodel hospital hygiene and challenge complacency about antibiotic-resistance.[380] Similarly, Colindale's visualisation of spreading resistance amongst enteric bacteria enabled researchers like Anderson to link resistance problems in human medicine to British farms.[381]

Tasked with undertaking a comprehensive review in the face of scientific warnings, the Joint ARC/MRC Committee on Antibiotics in Animal Feeding started work in April 1960.[382] However, the so-called Netherthorpe Committee's main body met only twice. During its first meeting in 1960, it installed a scientific sub-committee. Two years later, it endorsed the sub-committee's report.[383] The sub-committee itself met five times between 1960 and 1962. However, it soon became apparent that a fundamental rift divided members. While one faction consisting mostly of physicians and veterinarians attacked agricultural antibiotics on the grounds of antibiotic resistance, the other faction consisting of agricultural scientists and officials fiercely defended their use. In virtually every meeting, the heads of the respective factions, Drs. Gordon (veterinarian) and Braude (animal nutritionist), clashed on the relative costs and benefits of agricultural antibiotics.

When Dr. Williams Smith was invited to give evidence during the committee's second meeting in June 1960, he presented the committee with new

[378] Cf. Ibid., pp. 739-41.
[379] Cf. Ibid., p. 744.
[380] Cf. Ibid., pp. 737-41; 51-52; 60. (eigentlich 751, etc.)
[381] Anderson's co-publisher on horizontal resistance, Naomi Datta, had also worked at Colindale prior to moving to Hammersmith hospital; cf. *Post Penicillin Antibiotics: From Acceptace to Resistance? A Witness Seminar Held at the Wellcome Institute for the History of Medicine, London, on 12 May 1998* (6; London: Wellcome Trust, 2000), p. 46.
[382] Fearing undue commercial pressure on individual members, the ARC was initially in favour of keeping the existence of the first Netherthorpe Committee secret; cf. TNA FD 9/1458 (Minute Dr. Faulkner, 7 Mar, 1960).
[383] Cf. TNA FD 23/1936 (Report of the Joint Committee on Antibiotics in Animal Feeding, 1962).

data on the spread of antibiotic-resistance from animals to workers: in one survey, 88.3% of *Staphylococcus aureus* strains isolated from the noses of veterinary surgeons and farmers were penicillin-resistant – 14.7% of veterinarian-isolates were also resistant to chloramphenicol.[384] Referring to these results, Williams Smith warned that even the smallest level of antibiotic-use produced resistant pathogens.[385] In response, Dr Braude asked for conclusive evidence of actual harm resulting from resistant farm strains. Reluctantly, Williams Smith conceded that he was unable to supply direct proof. At the end of the meeting, the sub-committee compromised on the following statement: "therapeutic uses of antibiotics could lead to the production of resistant strains, (…) the dangers of uncontrolled therapeutic use should be born in mind."[386]

Remarkably, evidence submitted by the NFU contradicted agricultural experts' defence of antibiotics. The NFU submission contained three farmers' statements. One of the farmers confessed having used antibiotics illegally to feed breeding pigs,[387] a second farmer stated that he used penicillin but had "been very chary about the use of antibiotics" and had ignored "fashionable and extravagant claims of the broad-spectrum manufacturers."[388] A third farmer reported "certain instances where high-level doses of antibiotics have been used in an attempt to offset bad husbandry practices."[389] At the end of the meeting, the sub-committee's minutes poignantly noted "the difference of opinion between the farming members of the Joint Committee and the farmers whose opinion had been put forward as representative by the NFU."[390]

In view of its division, the scientific sub-committee was at an impasse by the end of its third meeting in October 1960. Acknowledging the impasse, Prof James Howie from the University of Glasgow presented three choices:

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[384] TNA FD1/8226 (ARC/MRC Joint Committee on Antibiotics, The Antibiotic Sensitivity of Strains of Staphylococcus aureus Isolated from the Noses of Veterinary Surgeons and Farmers, H. Williams Smith & W. E. Crabb)
[385] TNA FD1/8226 (ARC/MRC Joint Committee on Antibiotics, 2nd meeting Scient. Sub-Committee, 27 Jun, 1960), p. 2.
[386] Cf. Ibid., p. 3.
[387] Cf. TNA FD1/8226 (Information provided by the NFU, ARC 558/60), p. 1.
[388] Ibid.
[389] Ibid., p. 2.
[390] TNA FD1/8226 (ARC/MRC Joint Committee on Antibiotics, 3rd meeting Scient. Sub-Committee, 18 Oct, 1960), p. 4.

i. Complete prohibition of the addition of antibiotics to feedingstuffs (i.e. a reversion to the earlier situation, which would be very difficult)

ii. Maintenance of the present position (on the ground that the conflicting evidence did not provide any basis for a change)

iii. General permission to add antibiotics to feedingstuffs (on the ground that there was insufficient evidence to justify the withholding of such permission).[391]

Howie's phrasing was significant. By presenting only three choices – two of which were extremes – he transformed the *status quo ante* into an acceptable compromise. Both factions could subsequently claim to have prevented worse.

Yielding to Braude's objections, the sub-committee agreed that contemporary evidence was insufficient to warrant restricting existing feed antibiotics. Acknowledging an already common practice, the sub-committee also recommended permitting antibiotic feeds for calves. However, extending antibiotic feeds to layer birds and adult stock was not recommended. With both sides agreeing on the necessity of further research, the medical faction managed to push through a recommendation that new antibiotic feeds should be licensed on the basis of their irrelevance to human and animal therapy.[392] The suggested distinction between therapeutic and non-therapeutic antibiotics was not new: the Antibiotics Panel had discussed such a separation as early as 1956.[393] However, by inserting the concept of two-tier licensing into the sub-committee's report, the medical faction scored a major long-term victory. Changed licensing procedures would promote the development of non-therapeutic feeds. Once established, non-therapeutic antibiotic feeds would make penicillin and tetracycline-based feeds expendable. Following the first Netherthorpe report's

[391] Ibid., p. 5.
[392] Cf. FD1/8227 (Agricultural Research Council and Medical Research Council. Joint Committee on Antibiotics in Animal Feeding. Report of the Scientific Sub-Committee).
[393] TNA MAF 284/281 (Advisory Committee on Poisonous Substances, Meeting, 13 Nov, 1956; minutes Antibiotics Panel, comment Dr. Barnes); sensing a market opportunity in an oversaturated market, the German company Bayer had also sent a letter to the sub-committee advocating a new, specifically non-therapeutic feed; cf. TNA FD1/8226 ((ARC/MRC Joint Committee on Antibiotics, Scient. Sub-Committee. Antibiotic for Animal Feeding Use only, Suggestion by Bayer Products Ltd., [undated]); the feed market's saturation was pointed out at a meeting between MAFF and MH in 1963 when discussing the permission of bacitracin and neomycin in animal feeds; cf. TNA MAF 287/307 (Meeting MAFF, MH and ARC, 14 Jun, 1963), p. 2.

submission in 1962, the medical faction's recommendation played a major role in reshaping British antibiotic policy.

At the same time, the recommendation divided the pharmaceutical lobby. By the early 1960s, some European companies saw non-therapeutic antibiotics as a way to oust dominant American producers from the saturated feed market. Contacting the sub-committee during its supposedly confidential decision-making process, the German company Bayer played on fears of antibiotic resistance to promote a new non-therapeutic antibiotic.[394]

Even though the Netherthorpe report vindicated its antibiotic policy, the MAFF had to fight to maintain farmers' access to antibiotics. Conducted in 1961 and available to officials by mid-1962, the report of the Milk and Milk Products Technical Advisory Committee on penicillin residues in British milk was not published for nearly a year.[395] Closely followed by a critical WHO report, hard residue data forced British authorities to impose a penalty-based zero-tolerance policy for penicillin in milk.[396] One year later, graver challenges arose. In many ways, 1964 was an *annus horribilis* for MAFF: following the *Observer's* articles on *Animal Machines* in March, the Minister for Agriculture, Christopher Soames, was forced to establish the Brambell committee in April 1964.[397] Giving evidence to the Brambell Committee in June, the BVA warned "that the limitations (…) of controlling non-nutritional additives to animal feeding-stuffs constituted a threat to human health."[398] While Ruth Harrison continued to campaign against feed antibiotics on factory farms,[399] typhoid was spreading in Aberdeen.

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[394] TNA FD1/8226 ((ARC/MRC Joint Committee on Antibiotics, Scient. Sub-Committee. Antibiotic for Animal Feeding Use only, Suggestion by Bayer Products Ltd., [undated]); the feed market's saturation was pointed out at a meeting between MAFF and MH in 1963 when discussing the permission of bacitracin and neomycin in animal feeds; cf. TNA MAF 287/307 (Meeting MAFF, MH and ARC, 14 Jun, 1963), p. 2.
[395] Cf. 'Keeping Milk Free Of Antibiotics', *Times*, 30.05.1963, p. 18; TNA MAF 251/369 (Minute 11, C. E. Coffin, 20th July, 1962).
[396] Cf. Bud, *Penicillin: Triumph and Tragedy*, pp. 171-76.
[397] Cf. Ruth Harrison, 'Introduction', *Farm Animal Welfare. Summary of Proposals by the Ruth Harrison Advisory Group* (London: Education Services and Ruth Harrison, 1965), p. 17.
[398] TNA AJ 3/183 (An Enquiry into the effect on Human Health on the use of Antibiotics for Intensively Reared Animals with special reference to the Swann Committee's Report of December 1969, March 1970), p. 1.
[399] Cf. Harrison, 'Introduction'.

No doubt prompted by the typhoid outbreak, E.S. Anderson embarked on his study of animal and human resistance transmission in the same year.[400] Indeed, Ephraim Saul – alias 'Andy' – Anderson embodied a new type of opinionated and media-savvy public expert. As Robert Bud has shown, this new type of public expertise challenged the discreet clubroom atmosphere of previous British expert consultation.[401] The son of Estonian immigrants, Anderson had been a scholarship holder at Durham University and had become Arthur Felix' successor at Colindale's Enteric Reference Laboratory in 1953. Described in his obituary as "a hard taskmaster" with an "abrasive and perfectionist approach,"[402] Anderson cultivated useful friendships with journalists like the *Guardian's* Anthony Tucker and Bernard Dixon, future editor of the *New Scientist*.[403] Determined to restrict agricultural antibiotics, Anderson's personality and frequent use of media contacts would have a significant, yet ambivalent influence on British antibiotic policy.

Reacting to public and medical pressure, the British government recalled the Netherthorpe committee in 1965. Deliberating the situation, the committee called twice upon Anderson to give evidence. Not belonging to the faint-hearted and later accused of 'instigating' the whole committee,[404] Anderson passionately argued for a complete ban of subtherapeutic antibiotic feeds. While the Netherthorpe committee still considered evidence insufficient to warrant such a step,[405] Anderson's lobbying had an unforeseen consequence: having focused anxiety on resistant *S. typhimurium* in calves, Anderson enabled the committee to move beyond its previous impasse. Because antibiotic feeds for calves had not been legalised yet, penicillin and tetracycline resistance logically either resulted from illegal feeding or veterinary over-prescription. Unable or unwilling to readdress subtherapeutic antibiotics, committee members turned their attention towards veterinary prescription practices. In their draft report, members called for a new expert committee to investigate therapeutic uses of antibiotics in

[400] Anderson already had a lot of experience in this area: in 1959, his paper on *S. typhimurium* and chloramphenicol resistance had triggered the first Netherthorpe committee; cf. above.
[401] Cf. Bud, *Penicillin: Triumph and Tragedy*, pp. 176-83.
[402] Ibid.
[403] Cf. Bud, *Penicillin: Triumph and Tragedy*, pp. 177-78.
[404] Cf. TNA MAF 287/450 (Minute 4, W. D. Macrae to Mr. Field, 18 Jan, 1967), p. 1.
[405] Cf. Ibid.

human and veterinary medicine. Further recommendations included rationalising government bodies dealing with antibiotics and turning salmonellosis into a notifiable disease.[406]

However, reviewing all aspects of antibiotic-use proved contentious: not only would a review infringe on the jealously guarded legislative boundaries between the Ministries of Agriculture and Health, it also threatened the MH's almost finalised 1968 Medicines Act.[407] In view of the fragile situation, MH officials and Professor Lawrence Garrod pressed for a deletion of all references to human medicine during the Netherthorpe Committee's final meeting on 6th April 1966.[408] Submitted in early January 1967, the final Netherthorpe report merely recommended a review of "the use of antibiotics in animal husbandry and veterinary medicine and its implications in the field of public health."[409] However, the sub-committee's attached report stressed that evidence against subtherapeutic antibiotic feeds was inadequate.[410] In sum, the only area to be reviewed was veterinary medicine.

Very hostile to farmers' access to antibiotics, veterinarians did not take kindly to a review of their own prescription practices. During the 1960s, veterinarians' income was increasingly determined by sales of prescribed drugs.[411] At the same time, state-employed veterinarians were trying to gain influence in the field of public health. In contrast to other Western nations, British veterinarians were not in charge of a centralised meat inspection service.[412] While veterinarians controlled the few relatively large Scottish slaughterhouses, local medical officers or health inspectors were in charge of inspecting the numerous small English and Welsh slaughterhouses. Fragmented

[406] Cf. TNA MAF 287/450 (Annexe, ARC 22B/66, Agricultural Research Council and Medical Research Council. Joint Committee on Antibiotics in Animal Feeding. Second Report of the Scientific Sub-Committee), pp.1-2.
[407] Cf. Bud, *Penicillin: Triumph and Tragedy*, p. 181.
[408] Cf. TNA MAF 287/450 (Minute 4, W. D. Macrae to Mr. Field, 18 Jan, 1967), p. 2; TNA FD 7/899 (Note to Dr. Bunje, Note of a Meeting with the MAFF, February 13th, 1968).
[409] TNA MAF 287/450 (Annexe, ARC 2546/66, Agricultural Research Council and Medical Research Council. Joint Committee on Antibiotics in Animal Feeding) p. 1.
[410] TNA MAF 287/450 (Annexe, ARC 22B/66, Agricultural Research Council and Medical Research Council. Joint Committee on Antibiotics in Animal Feeding. Second Report of the Scientific Sub-Committee), p. 2.
[411] Verweis fehlt noch
[412] Cf. Smith et al., *Food Poisoning, Policy and Politics. Corned Beef and Typhoid in Britain in the 1960s*, pp. 204-15.

and underfunded, the British inspection system failed to achieve a 100% rate of post-mortem – let alone ante-mortem – inspections.[413] Although several committees had called for a centralised Meat Inspection Service, the MH favoured strengthening local authorities. In 1963 and 1965, new regulations extended inspections, controlled hours of slaughter and enabled local authorities to charge for their services. However, they did not create a centralised veterinary service or strengthen veterinarians' role in public health.[414]

In view of this recent defeat, veterinarians and the MAFF felt that the proposed review was another blow to the veterinary profession. Complaining about its one-sided focus, the ARC blocked the second Netherthorpe report's publication in January 1967.[415] Opinions in the MAFF were more nuanced: while one official downplayed the report as an uncomfortable "storm in a teacup,"[416] others anticipated "a first-class row with the Royal College and the BVA."[417] However, MAFF officials agreed that withholding publication was unwise and potentially damaging.[418] Powerless to override the ARC, MAFF officials lobbied the MH to extend the review to both agricultural and medical aspects of antibiotic use.

In doing so, officials cited a parallel report by MAFF's Scientific Advisory Panel (SAP). Apparently anticipating problems with the Netherthorpe report, MAFF had commissioned the SAP with a separate review in 1965. Headed by Alastair Frazer, a food additives expert with close ties to industry,[419] the SAP was advised by Sir Ernst Boris Chain, Nobel laureate and co-discoverer of penicillin. Citing falling incidences of resistant salmonellosis,[420] the SAP endorsed agricultural antibiotics.[421] Nonetheless, the SAP recommended a national

[413] Cf. Ibid., p. 205.
[414] Cf. Ibid., pp. 205, 14-15, Peter A. Koolmes, 'Veterinary Inspection and Food Hygiene in the Twentieth Century', in David F. Smith and Jim Philips (eds.), *Food, Science, Policy and Regulation in the Twentieth Century. International and Comparative Perspectives* (London and New York: Routledge, 2000), p. 59.
[415] TNA MAF 287/450 (Minute, J. Hensley to Mr. Bott, 9 Jan, 1967).
[416] TNA MAF 287/450 (Minute, J. Hensley to Mr. Bott, 22 May, 1967).
[417] TNA MAF 287/450 (Minute, E.H. Bott to J. Hensley, 23 May, 1967).
[418] TNA MAF 287/450 (Minute, J. Hensley to Mr. Bott, 22 May, 1967).
[419] Cf. D.W. Kent-Jones, 'Obituary. Alastair Campbell Frazer', *Proceedings of the Society for Analytical Chemistry,* 6 (1969).
[420] TNA MAF 284/282 (MAFF, Scientific Advisory Panel. The Use of Antibiotics in Agriculture and Food, Jan, 1967), pp. 3-8.
[421] Ibid., p. 12.

resistance study, a review of antibiotic control measures, and more research cooperation between medical and veterinary authorities.[422] Summing up the report, a MAFF official noted: "In other words, nothing we should do should impede the use of antibiotics in agriculture or food, though of course they must be used with reasonable safeguards."[423]

In spite of public pressure, intra-ministerial conflicts continued to delay action. By July 1967, Labour's Minister of Agriculture, Frederick – 'Fred,' later Baron – Peart became involved. During a meeting with Alastair Frazer and senior advisers, he agreed that the Netherthorpe report "created some unnecessary alarm, and that [it] picked out veterinarians."[424] Following an attack by Frazer on Anderson's data, Peart agreed to put further pressure on the MH to extend the planned antibiotic review to human medicine.[425] However, this only increased tensions. Referring to allegations of antibiotic overuse, an agricultural bureaucrat complained: "there has been a good deal of sniping from certain medical quarters (…), although I seem to recall something about 'people who live in glass houses.'"[426] In September 1967, the involved parties published a joint press statement. In the statement, all parties acknowledged and accepted most of the Netherthorpe recommendations but rejected monitoring plans for resistant salmonellosis.[427] However, an actual review remained unforthcoming. According to MRC Secretary Sir Harold Himsworth, the situation was frustrating:

> Commercial firms supplying the antibiotics tend to minimise the virtues of good husbandry and to press the use of antibiotics and the [MAFF] do not seem to take a firm line. (…) the Ministry of Health seem to have shown little interest in the problem, ...[428]

In December 1967, the tragic Teesside deaths finally shocked officials into action: exchanged minutes reveal that concern first arose when the BBC's *Twenty-four Hours* linked fatalities to antibiotic overuse in agriculture.[429]

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[422] Ibid.
[423] TNA MAF 284/282 (Minute, E.H. Bott to F.C. Parker, 13 Jul, 1967).
[424] TNA MAF 287/450 (Minute, B.H.B. Dickinson to Mr. Hensley, 24 Jul, 1967).
[425] Ibid.
[426] TNA MAF 287/450 (Minute, W.D. Macrae to Mr. Field, 4 Oct, 1967).
[427] TNA MAF 284/282 (Press Notice, 1 Sept, 1967).
[428] TNA FD 7/899 (Note: Sir Harold Himsworth, Antibiotics in Animal Foodstuffs, 20 Oct, 1967)
[429] Cf. TNA MAF 287/450 (Minute, C.H.M. Wilcox to Mr. Hensley, 22 Dec, 1967; Minute, J. Hensley to T.B. Williamson, 29 Dec, 1967); E.S. Anderson created additional pressure by claiming that the resistant strains might have human or animal origins; cf. TNA MAF 287/450 (Minute, T.B. Williamson to J. Hensley, 25 Jan, 1968).

Previously postponed by an outbreak of Foot & Mouth disease, an intra-ministerial meeting was hastily scheduled for 13th February 1968. According to an internal letter, "ministers are becoming increasingly vulnerable in this business and we ought quickly to settle our lines on Netherthorpe."[430] Employing martial rhetoric, a MAFF minute warned that the "[MH] have been preparing for the 'battle'. I think we too should gather our forces."[431] However, the MH did not give way. With the explicit support of the PHLS,[432] MH representatives argued:

> … that there was a problem in human medicine and this was receiving and would continue to receive consideration. This was, however, solely the responsibility of their Ministry.[433]

At the same time, health officials referred to the joint press statement's previous endorsement of the Netherthorpe recommendations. Licking their wounds, MAFF officials complained that the MH had treated the review's terms of reference as "a sacred cow which would not be sacrificed at any cost."[434]

Following the meeting, the next difficult question to settle was the review committee's membership. Feeling that the Netherthorpe Committee had been "over-weighted scientifically on the medical and para medical sides,"[435] the MAFF was keen to prevent the situation from reoccurring. Another point of contention was E.S. Anderson's role: should he be a committee member, or should he function as an adviser? Both ministries were aware of Anderson's public influence but equally wary of his vocal support of antibiotic restriction and temperamental character. In order to control Anderson, the MH suggested co-nominating Sir James Howie, Anderson's superior at the PHLS.[436] However, in his eagerness to be appointed, Anderson overshot his goal: in April 1968, he publicly announced that he would refuse to give evidence if he were not appointed to the committee.[437] This somewhat uncouth attempt to pressure his way into the confidential world of expert consultation was bound to backfire.

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[430] TNA FD 7/899 (T.B. Williamson to J. Hensley, 25 Jan, 1968)
[431] Cf. TNA MAF 287/450 (Minute, F.C. Parker to Mr. Bott, Mr. Field, Mr. Macrae, 1 Feb, 1968)
[432] Cf. TNA FD 7/899 (Note to Dr. Bunje, Note of Meeting with the MAFF, 21 Feb, 1968).
[433] TNA MAF 287/450 (Note of Meeting 'To Discuss the Second Report of the Joint ARC/MRC Committee on Antibiotics in Animal Feeding Stuffs', 13 Feb, 1968).
[434] TNA MAF 287/450 (Minute, W. D. Macrae, Inter-Departmental Meeting on the Netherthorpe Committee Report, 19 Feb, 1968).
[435] Ibid.
[436] TNA MAF 287/450 (Minute, G.J.L. Avery, Joint Committee on Antibiotics, 25 April, 1968).
[437] TNA MAF 287/450 (Minute, W.C. Tame to Secretary, 29 Apr, 1968).

Already sceptical of Anderson and his use of publicity, the MAFF could now argue that Anderson would endanger the committee's objectivity and public standing:

> If the committee's conclusions were in line with Dr. Anderson's views, there would be the charge that we had biased it with prejudiced members; if it went the other way, Dr. Anderson would no doubt issue a minority report.[438]

Even Prof Howie, who had previously refused to accept a committee position without Anderson's co-nomination, now changed his mind. A minute triumphantly noted:

> Dr. Howie has become impatient of the Prima Donna approach of his colleague Dr. Anderson and is no longer prepared to support him.[439]

By May 1968, all important decisions had been made: E.S. Anderson had been substituted with a public health expert from Birmingham. Meanwhile, the molecular biologist and vice-chancellor of the University of Edinburgh, Michael – later Baron – Swann, had accepted chairmanship of the committee. Fearing public attacks by Anderson, the MAFF had, however, withdrawn its nomination of Alastair Frazer. In a smart move, agricultural officials convinced the MH to nominate two veterinarians in Frazer's stead. Comprised of two agriculturalists, three veterinarians and two medical scientists, the review committee was weighted slightly in favour of agricultural interests.[440] Sixteen months after the second Netherthorpe report, one official mused:

> I must confess that there is no adequate reason for the fact that it took us some nine months to decide to accept the report of the Joint ARC/MRC Committee to set up a Committee to go further into the matter.[441]

Starting its work in July 1968, the Joint Committee on the Use of Antibiotics in Animal Husbandry and Veterinary Medicine had to strike an acceptable compromise between agricultural interests and public anxiety. At the same time, it had to reconcile its proposals with the 1968 Medicines Act. In contrast to previous committees, the exit-strategy of maintaining the *status quo*

[438] Cf. TNA MAF 287/450 (G.J.L. Avery to Mr. Tame, 02 May, 1968); Anderson subsequently approached MP David Kerr to lobby for his nomination to the committee; cf. TNA MAF 287/450 (Dr. David Kerr (MP) to Rt. Hon. Cledwyn Hughes (MAFF), 22 May, 1968).
[439] TNA MAF 287/450 (Minute, J.G. Carnochan to Mr. Tame, 3 May, 1968).
[440] Cf. TNA MAF 287/450 (Committee on the Use of Antibiotics in Animal Husbandry and Veterinary Medicine. Proposed Members).
[441] TNA MAF 287/450 (Minute, W.C. Tame to Mr. Williamson, 6 May, 1968).

was no longer available. Meanwhile, public pressure for action increased significantly between December 1968 and April 1969 when 30 babies died from resistant gastroenteritis in Manchester in a grotesque repeat of the Teesside outbreak.[442]

In November 1969, the committee submitted the so-called Swann report. However, the report read like a pastiche of earlier recommendations: the committee advised the British government to cut the number of advisory bodies and install a permanent committee tasked with all aspects of British antibiotic use. It also called for a ban of antibiotic advertising to lays, further research and more funding of preventive veterinary medicine. Most significantly, the committee recommended a complete separation of therapeutic and nontherapeutic antibiotics and a ban of penicillin, tetracycline and oxytetracycline in feeds. It also cautioned against the therapeutic use of chloramphenicol in agriculture but did not recommend a ban.[443]

In contrast to later tales of British *avant-garde* policy,[444] the Swann recommendations only represented a minimum commitment to action. Given its well-chosen terms of reference and membership, it had always been unlikely that the Swann committee would go against vested interests. More significantly, most of its important decisions had been 'pre-framed': although the first Netherthorpe committee had refrained from banning existing growth promoters, its recommendations had ensured that nontherapeutic alternatives were readily available by 1969. Echoing nearly 20 years of expert advice, the call for a permanent committee on antibiotics was hardly new and had been facilitated by the 1968 Medicines Act. By 1969, informal gentlemen's agreements' were being replaced by statutory obligations to apply for and hold product licences.[445] Furthermore, the Swann report did not call for enforceable residue limits,

[442] Cf. 'Action sought on antibiotics after babies' deaths', *Times*, 14.04.1969, p. 2; cf. also: 'Baby-killer bug traced', *Observer,* 13.04.1969, p. 7.
[443] Cf. 'Report of the Joint Committee on the Use of Antibiotics in Animal Husbandry and Veterinary Medicine, 1969-1970.', (London, 1969).
[444] Cf. TNA MAF 416/85 (Minute, E. Doling, 1 Sep, 1970).
[445] Cf. Cf. TNA MAF 284/281 (Control of Antibiotics, Feb, 1969), p. 1.

systematic antibiotic enforcement on farms or a ban of on-farm mixing of antibiotic concentrates.[446]

At the same time, the Swann committee missed its chance to push for stricter regulation of veterinary practice. Tarnished by the second Netherthorpe committee, veterinarians emerged from the Swann report as knights in shining armour. Commenting on Swann, the BVA announced that it was willing to take on the additional burden placed on its shoulders by the ban of therapeutic growth promoters.[447] However, far from being a 'burden', banning penicillin and tetracycline feeds actually increased veterinarians' control over the medicated feed market. Due to their monopoly 50% mark up charge on prescribed drugs, veterinarians made a sound profit from selling both of the previously deregulated drugs. Even though the Swann report mentioned "ill-informed prescription in man and in animals", the BVA claimed that lacking evidence of malpractice meant that veterinarians "need not, then, be ashamed of [their] record in using antibiotics."[448] Discussing veterinarians' continued access to chloramphenicol, officials noted that "issues other than the purely scientific"[449] had influenced Swann.

As a consequence, criticism and support of Swann divided traditional camps. While Eli Lilly, Cyanamid and Pfizer claimed that the proposed antibiotic bans would cost British farmers £30.9 Million annually,[450] the Farm and Food Society criticised Swann as a further triumph of economy over health: "present methods of intensive animal husbandry are building up disease in stock. (…). Stockmen in charge of many thousands of creatures cannot give them even normal individual attention, let alone the extra attention which such methods demand." [451] By contrast, both the Association of the British Pharmaceutical

[446] Cf. Peter Bell, 'Never a dull moment, with Drugs and Sheep and Crippling Tax', *British Farmer*, no. 628, 29.11.1969, pp. 1-2.
[447] Cf. Anthony Tucker, 'Antibiotics to be banned from animal feeds', *Guardian*, 21.11.1969, p. 20;
[448] TNA AJ 3/183 (Joint Statement by the British Veterinary Association (July 1970)), p. 1.
[449] TNA FD 7/900 (Note on file: BL to Dr. Bunje and Dr. Clements, 27 Sep, 1968); cf. also TNA FD 7/899 (Note: 10 Oct, 1969).
[450] Cf. 'Antibiotic curbs 'will hit farmers'', *Guardian*, 06.01.1970, p. 4.
[451] TNA AJ 3/183 (An Enquiry into the effect on Human Health of the use of Antibiotics for Intensively Reared Animals with special reference to the Swann Committee's Report of December 1969), p. 6.

Industry[452] and the Consumer Council's Research Officer praised Swann: "It is gratifying to note that the United Kingdom will be leading the world in the field, …"[453]

[452] TNA AJ 3/183 (Press Statement: abpi pharmaceutical industry press information 912/69, 20 Nov, 1969), p. 1.
[453] TNA AJ 3/183 (D.I. Richardson to F.C. Parker, 18 Dec, 1969).

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